Journal

of the

Royal Army Medical Corps

Journal

OF THE

Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTED BY

LIEUTENANT-COLONEL C. J. COPPINGER

AND

LIEUTENANT-COLONEL A. DAWSON, R.A.M C.

MANAGER:

MAJOR S. W. KYLE, R.A.M.C.

VOL. LVI.

January—June, 1931.

JOHN BALE, SONS & DANIELSSON, LTD.

83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W. 1.

Vol. LVI. JANUARY, 1931. No. 1.

Journal
of the
Royal Army Medical Corps.

Original Communications.

NOTES ON AN OUTBREAK OF AMŒBIC DYSENTERY OCCURRING AMONG THE HOUNDS OF THE BANGALORE HUNT.

By Major J. S. K. BOYD,
Royal Army Medical Corps.

Although it is not generally recognized that the dog may suffer from amœbic dysentery, the existence of this condition is by no means unknown, and small outbreaks and individual cases have been described from time to time in various parts of the world. A list of references to some of the literature on the subject is appended. It is interesting to note that one of these articles [4] describes an outbreak at Ootacamund, which is approximately only 200 miles from Bangalore, in which place the cases now to be described occurred.

History of the Outbreak.

The Bangalore Hunt pack in March, 1930, consisted of thirty-four dogs and twenty-eight bitches. They were fit and in good condition. There had been no epidemic disease for some considerable time, and so far as is known no outbreak of any disease resembling true dysentery had ever occurred in the pack.

Case 1.—"Diligent," male, weight about 60 pounds.

March 27, 1930: Noticed by the kennelman to be off colour, and to be passing blood and mucus per anum. A specimen sent to the laboratory presented the typical characters to be described later, and contained active amœbæ. Because of its resemblance to the human condition the case was diagnosed amœbic dysentery.

The hound had no fever, but was dull and lethargic. Diarrhœa was marked, the bowels moving many times per day, and a few cubic centimetres of blood-stained mucus being passed on each occasion. The appetite was poor.

Treatment: diet was restricted to milk thickened with arrowroot. Emetine hydrochloride, $\frac{1}{2}$ grain, was given subcutaneously and continued over a period of twelve days.

April 3, 1930: Diarrhœa has diminished greatly; mucus is thicker and more yellow in colour; no amœbæ can be seen. 6th: Still improving; mucus of the same type present; no amœbæ. 12th: Brown fæcal stools containing no blood or mucus, no amœbæ, no cysts. 15th: Blood and mucus containing amœbæ again present. Decided to try a course of emetine bismuth iodide. 19th: A first dose of E.B.I., 1 grain, given in the afternoon, the hound having had no food since morning. Three hours later noticed to be very ill and breathless, and five hours later died. No vomiting was noted.

Post Mortem.—Although the dysenteric condition of the large intestine was well marked (this being confirmed later by microscopical examination), the immediate cause of death was found to be cardiac failure, which must be chiefly attributed to the toxic action of the E.B.I. This will receive full consideration later in the report.

Case 2.—" Lawful," female, weight about 80 pounds.

April 4, 1930: Symptoms similar to those of "Diligent." Blood-stained mucus containing amœbæ present in considerable quantities.

Treatment as in Case 1 instituted, but in view of the greater weight of the hound and the fact that this dosage was successfully employed by Ware [4], emetine hydrochloride, 1 grain daily, was given.

April 13: Diarrhœa with blood and mucus has continued throughout this period. The hound's general condition otherwise has appeared good, and it was a very unexpected disappointment when this morning she was found dead.

Post Mortem.—Unfortunately all the organs had been removed from the body and cut up before my arrival. This hound died at an earlier date than did Case 1, and the possibility of emetine poisoning was not fully realized.

In addition to the dysenteric condition of the large intestine, an intense congestion of the small intestine was noted. As far as could be ascertained from sections, this bore no relation to the dysenteric infection, and in the light of later experience it seems probable that cardiac failure resulting from emetine may have played its part.

Case 3.—" Hecuba," female. Weight about 80 pounds.

April 8, 1930: Presented symptoms similar to other cases, but less severe.

This hound, according to the kennelman, had similar symptoms two years ago. She had been procured for breeding purposes, but had never

been healthy, and never hunted. Two litters of puppies all died shortly after birth. The M.F.H. decided that it was useless to attempt to cure her. She had been maintained for some time for reasons of kindness only. She was accordingly destroyed on April 14, without having received any specific treatment.

At the time it was thought that this hound might be the carrier responsible for the other cases. Repeated examinations failed to reveal the presence of cysts.

Post Mortem.—Scattered lesions of the large intestine were found which will be described later.

Case 4.—"Notable," female, weight about 70 pounds.

April 18, 1930: Found to be suffering from the usual symptoms and put on treatment. Emetine hydrochloride, $\frac{1}{2}$ grain, given subcutaneously for twelve days, i.e., from April 18 to 29.

April 29: Still diarrhœa with blood and mucus and numerous amœbæ. May 7 to 18: Emetine hydrochloride, $\frac{1}{4}$ grain, morning and evening, combined with active saline treatment. 18th: Amœbæ still present. 20th to 30th: Amibiasine, 1 drachm morning and evening, combined with saline treatment. 24th: Amœbæ still present. June 2: Amœbæ still present. 9th: Still small quantities of blood and mucus with amœbæ in the stools. The hound, however, is quite bright and lively. 11th to 17th: Stovarsol, 2 grains morning and evening, combined with saline treatment. 22nd: Stools practically normal. A small portion of blood and mucus with amœbæ found. June 24 to July 9: Stools normal throughout. Eleven negative microscopical examinations made. The hound appears quite fit in every way and was returned to the pack on July 9. Is still fit, August 28.

Case 5.—"Beery," female, weight about 60 pounds.

April 19, 1930: Symptoms noted by kennelman, but no specimen obtainable. 21st: Specimen procured and sent to the laboratory. Usual characters. Symptoms fairly acute. April 21 to May 2: Emetine hydrochloride, $\frac{1}{2}$ grain subcutaneously daily. 4th: Amœbæ still present, but symptoms much less severe. 7th to 18th: Emetine hydrochloride, $\frac{1}{4}$ grain morning and evening, combined with active saline treatment. 23rd: Blood and mucus with amœbæ still present. 25th: Blood and mucus; no amœbæ seen. 26th: Blood and mucus with amœbæ. 28th to 30th: No blood or mucus; no amœbæ found. June 2: Blood and mucus with amœbæ present. The actual quantity of blood and mucus has for some time been trifling. The stools are in the main composed of brown fæcal matter. Very little diarrhœa. 11th to 17th: Stovarsol, 2 grains morning and evening, combined with saline treatment. 16th: Still a trace of blood and mucus with amœbæ. 22nd: Still a trace of blood and mucus with amœbæ. 24th, 25th, 27th: Negative; stools normal. 28th: Mucus; chiefly degenerate epithelial cells; no amœbæ; no red blood-cells recognizable microscopically. 30th: No blood or mucus; no amœbæ.

July 1 : Blood and mucus with amœbæ present. 4th : Blood and mucus with amœbæ present. 2nd to 8th : Stovarsol, 2 grains morning and evening, combined with salines. 5th to 7th : A little mucus showing epithelial cells present; no amœbæ. 9th : No blood or mucus; no amœbæ. 12th : Again a trace of blood and mucus with amœbæ. 14th : Solid stool with a trace of mucus in which amœbæ were found. 18th : Normal stool; no mucus nor amœbæ. 19th : Normal stool; no mucus nor amœbæ; hook-worm eggs. 22nd : Normal stool. 26th : Solid stool; trace of mucus; no amœbæ. 28th : Solid stool; trace of mucus; no amœbæ. The hound is now in good condition. Returned to the pack. August 28 : Has remained perfectly fit.

Case 6.—" Winsome," female, weight about 75 pounds.

April 23, 1930 : Typical symptoms noted. Stools contained blood and mucus showing numerous amœbæ. April 23 to May 4 : Emetine hydrochloride, ½ grain daily, subcutaneously. May 13 to June 9 : All specimens submitted for examination negative. 11th to 17th : Stovarsol, 2 grains morning and evening, combined with salines. 21st : A small portion of blood and mucus was noticed as part of an otherwise brown fæcal stool. Amœbæ were present. There was no marked diarrhœa, and the hound appeared relatively fit. This state of affairs continued until July 9, the stool generally showing a trace of blood and mucus. July 2 to 8 : Stovarsol, 2 grains morning and evening, combined with salines. 12th, 14th and 18th : Normal stool; no mucus; no amœbæ. 19th and 22nd : Solid stool with trace of mucus, no amœbæ. 26th and 28th : Normal stool ; no mucus ; no amœbæ. The hound is in excellent condition. Returned to the pack. August 28 : Still fit ; no return of symptoms.

Case 7.—" Cracker," male, weight about 65 pounds.

May 16, 1930 : Usual symptoms noted. The blood and mucus contained active amœbæ. 16th to 30th : Amibiasine, 1 drachm morning and evening, combined with salines. May 20 to June 24 : Fluid stools, the result of salts, but no blood nor mucus ever seen. Seven negative microscopic examinations made in this period.

This was a mild case from the beginning. The hound was returned to the pack on June 25. At first it was much off colour, but gradually recovered condition and is now quite fit. There has been no recurrence of symptoms. (Since destroyed for reasons unrelated to its illness.)

Case 8.—" Nonsense," female. Weight about 50 pounds.

May 16, 1930 : Usual symptoms with blood and mucus and amœbæ. 16th to 30th : Amibiasine, 1 drachm morning and evening, combined with salines. 28th : Blood and mucus with amœbæ still present. May 29 to June 24 : Fluid stools the result of salts, but no blood nor mucus seen at any time. Seven negative microscopic examinations made in this period. Returned to the pack on June 25, and August 28 is still doing well and free from symptoms. This also was a mild case.

Character of the Stools.

Naked-eye Appearance.—In the acute stages the motions consist almost entirely of blood-stained mucus. This has a deep chocolate red colour, and usually shows a certain amount of admixed brown fæcal matter. When the hound is under treatment with salines, a brown watery motion in which shreds of blood and mucus are present occurs. The total amount of blood and mucus passed at a time rarely exceeds two or three cubic centimetres. In the more chronic stages, in the absence of saline treatment, formed or semi-formed stools are passed in which may be found a small portion of blood-stained mucus.

Microscopic Appearances.—In the active phases the predominant cell is the red blood-cell. Epithelial cells and macrophages may be seen, but polymorphs are conspicuous by their absence. On no occasion has the mucus presented cellular characters suggestive of bacillary exudate. Amœbæ are numerous, and in some cases very numerous indeed, as many as twenty being present in one field.

When recovery is about to occur, mucus is found which is of a different nature. Although it is still of a reddish tinge, few red blood-cells can be seen. The predominant cell is the epithelial cell, which is more or less degenerate. Amœbæ are absent.

Morphology of the Amœbæ.—When rounded the amœbæ measure from 18 to 30 microns in diameter, the average of a series measured being 25·5.

As seen in freshly-passed stools, the differentiation of ectoplasm and endoplasm is not well marked, save that when the amœba is progressing in slug-like fashion, it is preceded by a pseudopodium which consists, as far as its free extremity is concerned, of ectoplasm only.

The endoplasm shows distinct granularity. In the unstained condition the nucleus is practically invisible, and can only occasionally be distinguished as a faintly outlined circle. Vacuolation is in many cases well marked. Red blood-cells are freely ingested. Little granules and rods can frequently be seen in the endoplasm in both living and stained specimens. These are not, however, enclosed in vacuoles, and are probably not ingested bacteria. Occasionally a single large and apparently empty vacuole is the most conspicuous feature in an amœba.

Movement takes the form of rapid progression, the amœba under these circumstances being of an elongated shape, between two and three times as long as it is broad. A blunt pseudopodium, tipped with ectoplasm, flows in front, and the remainder of the amœba glides after this, ingested red cells and other granules rolling over and over one another. Frequently the posterior extremity is drawn out into a little pointed tag.

Under the climatic conditions prevailing when these cases occurred (the day temperature ranging from 90° to 100° F.), active movements persist for some hours after the specimen is passed. Ultimately the amœbæ become more sluggish, and finally round off and die.

Stained with iodine, many turn a mahogany brown colour, indicating the presence, presumably, of quantities of glycogen in their cytoplasm.

In wet-fixed preparations stained with Heidenhain's hæmatoxylin, the structure of the nucleus can readily be seen to correspond in the majority of cases to that of *E. histolytica*; i.e., there is a peripheral ring of fine chromatin granules just under the nuclear membrane, and a more or less centrally placed karyosome, with an absence of chromatin deposits elsewhere on the linin network. In certain cases the peripheral chromatin is coarser and more irregular than has been described, but certain observations indicate that this change occurs in nuclei about to divide.

Cultures of the amœbæ were readily obtained on the usual media, and kept alive by subculturing for some weeks. At no time were cysts found in any of the numerous cultures made.

Bacteriological Examination.—In view of the possibility of bacteria of the dysentery or Salmonella groups playing a part, numerous cultures were made under circumstances where the chances of recovering an organism of this kind, had it been present, were high. All were negative.

Morbid Anatomy and Histopathology.

Naked-eye Appearances.—Case 1 presented the most advanced changes. The lesions were confined to the large intestine, the surface of which was covered with clinging blood-stained mucus which had to be washed away before an examination could be made. The bowel wall appeared thinner than normal, and the rugæ were considerably flattened out. A moderate degree of congestion was present, irregular but very shallow erosions of the mucous membrane occurred, which were more marked in the depths of the folds of the rugæ. In consequence of this the specimen when held up to the light had a peculiar mottled appearance. These erosions involved a considerable area of the bowel surface.

The transition from normal to abnormal was very indefinite, so that there was nothing in the way of an "edge." There was no suggestion whatsoever of the button-hole type of ulcer seen in human amœbic dysentery, with thickening of the surrounding bowel wall and raised and undermined edges to the ulcer.

Case 2 showed the same layer of glutinous blood-stained mucus covering the wall of the large intestine. The wall appeared to be much thinned. No erosions nor ulcers could be detected by the naked eye, but there was considerable congestion. The small intestine was also congested, but showed no ulceration nor erosion.

Case 3 presented a rather different picture. There was the same layer of mucus, but not so marked. The wall of the large intestine appeared of normal thickness, and rugæ were well developed. Near the cæcal end there were a few discrete and somewhat raised patches showing surface erosion with a fair degree of congestion both of the patches and of the surrounding area. The small intestine and all other organs were normal.

In all cases the cæcum (which in the hound merits its name, being a blind diverticulum some inches in length) was affected to a greater or lesser extent, and was found at autopsy filled with blood-stained mucus.

Microscopic Appearances.—Numerous blocks were cut from all cases, and the following description is a composite picture:—

Probably the most interesting feature, common to all, is that penetration of the tissues by the amœbæ does not occur. It is true that in one or two places an isolated amœba was discovered, but their rarity was such as to render the finding of no significance. In parenthesis, quite good "imitation" amœbæ were provided by the nerve-cells of the sympathetic ganglia, which were present in considerable numbers.

The earliest change is a necrosis of the most superficial cells of the mucous membrane. This is accompanied by some congestion of the underlying vessels and by a round-celled infiltration of the submucosa, the cells being noticed first in an irregular layer just external to the muscularis mucosæ. In Case 2 these were practically the only changes found. These conditions progress simultaneously, the necrosed epithelium being shed and the remaining layer of mucosa becoming thinner and thinner. At first the infiltration of the submucosa leads to an increase in the thickness of this layer. The muscularis mucosæ, a very conspicuous structure in sections through normal parts, becomes broken up and finally disintegrated.

Ultimately the entire mucous membrane and submucosa disappear, and there remain only the two muscular layers covered by a thin stratum composed of a loose reticulum in whose meshes are numerous mononuclear cells, many of the plasma-cell type.

The transition from abnormal to normal in a lateral direction is rather more abrupt than the naked-eye appearances would lead one to believe. There is, however, no suggestion of undermining of the mucosa, and the lesions do not in the least resemble those obtaining in human amœbic dysentery.

The difference in the appearances in Case 3 seem to arise from the fact that secondary infection had occurred. In addition to the above changes a well-marked infiltration with polymorphs was present, which accounted for the thickening of the submucosa.

With the exception of simple congestion, which was present in Case 2, no pathological changes were found in the small intestine.

Relationship of the Amœbæ to the Lesions.

As no penetration of tissues by the amœbæ occurred, it becomes necessary to consider if in fact there is any reason to regard the amœbæ as pathogenic and not merely as commensals.

Whilst there is no direct evidence of their pathogenicity, the case presented by circumstantial evidence is a fairly strong one.

(1) The salient symptom was diarrhœa associated with the passing of

blood and mucus, in which hæmatophagous amœbæ identical with those causing human amœbic dysentery could readily be discovered.

(2) Up to a point the condition responded to the administration of emetine, the diarrhœa decreasing and the blood and mucus becoming less, and finally absent. Prior to its complete disappearance, the character of the mucus changed. Red cells became scanty, being replaced by desquamated epithelium. Shortly after the initiation of this stage amœbæ could no longer be discovered in the mucus. In all emetine treated cases, however, relapse occurred.

(3) Numerous examinations of the stools of cases between relapses, of the stools of hounds which had recovered, and of all other hounds in the pack which were unaffected, failed to reveal such amœbæ at any time.

(4) Relapses, signalized symptomatically by the return of blood and mucus in the stools, were invariably accompanied by the reappearance of amœbæ therein.

(5) The fact that the lesions were confined to the large intestine, and that the cellular reaction was a mononuclear one (except in the presence of secondary infection) is in keeping with amœbic dysentery.

(6) Bacteriological investigation failed to provide any explanation of the colitis.

(7) An interesting analogy is afforded by the work of Brumpt. This eminent authority is of the opinion that the protozoon named by the British school *E. histolytica*, and regarded as the cause of amœbic dysentery in man, is not an entity, but that there are included under this name three species which present only slight morphological differences. These he names *E. dysenteriæ* (the pathogen of the human disease), *E. hartmanni* and *E. dispar* (which do not produce lesions in man). These are to be distinguished chiefly by their pathogenicity to kittens. *E. dysenteriæ* produces lesions similar to those occurring in man; *E. hartmanni* is non-pathogenic, whilst *E. dispar* gives rise to a condition regarding which the following is a translation of the author's words [7]: "They cause a slow surface necrosis of the mucosa, without any of the congestion, inflammatory thickening, and ulceration characteristic of *E. dysenteriæ*, although present in far greater numbers than usually found in *E. dysenteriæ* infections."

Elsewhere [8] he emphasizes the fact that macroscopic ulceration and thickening of the bowel wall are not encountered.

It will be admitted that there is a considerable resemblance between this and the changes found in the hounds, although actually in the latter the degree of necrosis and of reaction thereto is more intense.

It is suggested that in the cases described the amœbæ live and multiply on the surface of the mucosa, producing an enzyme which brings about a gradual necrosis of that membrane and the underlying tissues, and calls forth on the part of the host a mononuclear exudate.

Epidemiology.—It will have been noticed that so far no reference has

been made to cysts. This has arisen because, in fact, cysts have not entered into the picture.

Neither in acute cases, in cases between relapses, in convalescent cases, nor in the normal hounds comprising the remainder of the pack (fifty-four in number at the time in question) which have all been carefully examined, has anything in the nature of an entamœba cyst been found.

This, however, is no new discovery, as Dobell [2], in 1919, states that "nobody has yet discovered the cysts of *E. histolytica* in the stools of infected animals"—referring specifically to dogs. The same observation has been definitely made with regard to the kitten, another potential host of *E. histolytica*.

Now it has repeatedly been demonstrated that infection does not occur as the result of the ingestion of the active amœboid form of the amœba. From these two observations it is clear that the hounds are not a source of infection to themselves, and that an outside cause common to all is to be sought.

With this in view (and after considerable delay owing to evasions on the part of the victims, who envisaged dire penalties should they be found responsible) the two European kennelmen and four native "dog-boys" were examined, and without difficulty a carrier was discovered. His cysts were typical *E. histolytica* cysts, measuring between 10 and 12 microns in diameter. Vegetative amœbæ of the *histolytica* type were also found in going over a number of stained specimens of his fæces. None were noted in the fresh specimen examined.

To round off the whole investigation in a most unexpectedly orthodox way, inquiry revealed the fact that this particular dog-boy was the cook who prepared the food for the pack. He gave no history of dysentery or any intestinal irregularity. As he was a useful man, it was decided to treat him, and he was given a daily injection of 1 grain of emetine hydrochloride. To this his infection readily responded, and since the termination of the course repeated examinations have failed to reveal the presence of amœbæ or their cysts in his stools.

Here again, although direct evidence is lacking, circumstantial evidence is strong. It has been shown that the hounds were not a source of danger to themselves. The only likely source of infection was a human being; and the particular human found to be a carrier was the one with the best opportunity to transmit his infection. Since he ceased to be a source of infection ten weeks ago, no further cases have occurred.

Treatment.

From the results obtained in such a small series of cases as this, it is obviously impossible to dogmatize regarding treatment.

There is, however, one very important fact to record, and that is the apparent toxicity of emetine to the dog. In Case 1 there is no reasonable doubt that death was precipitated by the dose of 1 grain of emetine

bismuth iodide (a small dose for a hound weighing 60 pounds) which had just been administered. It is true that the intestine showed well-marked lesions, but it is unlikely that these gave rise to such a sudden fatal issue. The way in which collapse followed the dose of E.B.I., and the signs of cardiac failure noted post mortem (the heart was of a purple colour, the coronary veins were markedly congested, the right side of the heart was dilated, and the bulk of the blood was in the splanchnic veins) all pointed to one cause. In Case 2 the organs had been removed and cut up before they were seen by me, and signs of cardiac failure were not noted. The possibility of emetine poisoning as the cause of death was not at the time recognized, but in the light of later experience it is by no means certain that this did not play a part.

The experience of Bauche and Motais [6] is of interest in this connection. These authors diagnosed and treated with emetine a case in a dog in Indo-China. After a dose of 4 centigrammes (approximately $\frac{2}{3}$ of a grain) the dog developed frequent attacks of vomiting, with progressive debility and weakness, and died some four days later. Although ulcerations of the large intestine were present (necrotic lesions of the mucosa and submucosa, but not containing amœbæ), the authors concluded that death was probably due to emetine poisoning. The total quantity of emetine administered was only 0·14 gramme in three doses over a period of twenty-two days.

In view of the nature of the lesions, and the fact that the amœbæ are on the surface and have not penetrated the tissues, it seems possible that a mechanical washing away of the mucus in which the amœbæ live would of itself be largely effective in curing the condition. This treatment, in the form of saline purges, and combined with the oral administration of a preparation called "Amibiasine," was adopted in Cases 7 and 8 with, as far as can be judged, very good results. These two hounds, which were diagnosed early in the course of the disease, recovered rapidly, and have now been fit and free from symptoms for a period of three months.

Amibiasine (compound extract of garcinia) is a proprietary preparation which had previously been used in the kennels for cases of diarrhœa, with apparent good effect. Although its use was attended with these happy results in Cases 7 and 8, it had no particular action in Cases 4 and 5, where it was given after the onset of the more chronic stage.

Stovarsol was tried in the more chronic cases, and seemed to produce an improvement in the general condition of the hound, although it did not completely banish the amœbæ.

It will be observed that two cases (5 and 6) repeatedly relapsed to the extent of having traces of mucus with amœbæ in otherwise normal stools. It is highly probable that this residuum of infection was situated in the cæcum, whose anatomical structure is such that mechanical cleansing by saline aperients must be ineffective, and complete emptying rare.

As regards diet, fluid diet was given during the acute stages, but in

convalescents and in chronic cases where the area involved was obviously a trifling one, a full diet of a non-irritant type was substituted without any bad local effect, and with marked benefit to the general condition of the hound.

To summarize, it is suggested that best results will be obtained by establishing diagnosis as soon as possible, and instituting treatment with saline aperients and some such drug as stovarsol or, possibly, amibiasine. During the acute stage fluid diet should be given, but when active symptoms have subsided, treatment, both medicinal and dietetic, should be directed to improving the general condition of the dog. There seems to be a considerable tendency for spontaneous cure to occur under these circumstances.

Relationship to Human Amœbiasis.

Considerable interest centres round these findings when they are considered in relation to the theories sponsored by Brumpt.

There are many cases on record (summarized by Dobell [2]), to show that dogs can suffer from amœbic dysentery in which the lesions correspond more or less closely to those in man, i.e., which show obvious naked-eye ulceration, thickening of the submucosa, undermining of the mucosa, penetration by the amœbæ, etc.

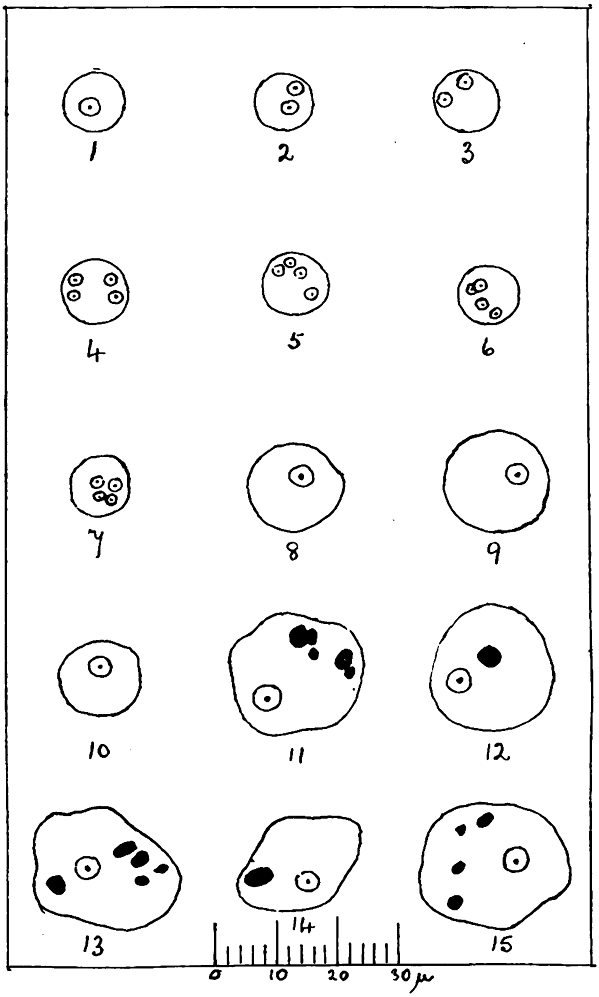
Here, however, we have occurring under natural—not experimental—conditions a different state of affairs, and one which bears more than a superficial resemblance to that described by Brumpt as resulting in the kitten from infection with *E. dispar*. Further, the only traceable source of infection (by circumstances of propinquity a likely one), was a human being passing *histolytica* cysts who gave no history of ever having suffered from dysenteric symptoms.

Another point of interest is that the vegetative amœbæ discovered in stained specimens of stools of the human carrier were all distinctly small, the average of a series of ten being 14·8 microns. Brumpt states that *E. dispar* in the intestine of man produces only "minuta" forms. While 14·8 microns is larger than the usual minuta forms, it is nevertheless a low average measurement.

Per contra, a large number of the amœbæ seen in the hounds' fæces were hæmatophagous, whereas, according to Brumpt, this is not the case with *E. dispar* in the kitten.

In Madras District during 1929 ninety-four "carriers" of *histolytica* cysts were detected among "food handlers" (cooks, water-carriers, waiters, bakers, etc.) in military employ, whilst only ten cases of amœbic dysentery occurred among the troops they were serving. The discrepancy is a big one, and raises the question as to whether all these cysts described as *histolytica* are actually capable of producing a condition of amœbic dysentery. Brumpt's theory that different species of amœbæ can produce cysts of identical appearance is certainly a possible explanation of this

phenomenon, and the partial corroboration which this small outbreak affords of his experimental findings with the species he names *E. dispar* is not without significance.



Camera Lucida Outline Drawings. (All from smears wet-fixed in Schaudinn's fluid, and stained with Heidenhain's hæmatoxylin.

Figs. 1 to 7.—Cysts in the fæces of the human carrier.
Figs. 8 to 10.—Amœbæ from the carrier.
Figs. 11 to 15.—Amœbæ from some of the cases. Note the ingested red cells, many of which are partly disintegrated.

Summary and Conclusions.

(1) Hounds are capable of suffering from, in epidemic form, amœbic dysentery caused by an amœba presenting all the morphological characters of *E. histolytica*.

(2) As far as was observed in a large number of examinations cysts are not formed. As extensive experimental evidence shows that vegetative amœbæ are not, under natural conditions, a potential source of infection to others, it follows that infection from hound to hound is impossible.

(3) An apparent source of infection was discovered in the "dog-boy" who prepared the food for the pack. Since he was dealt with by isolation and treatment no further cases have occurred.

(4) The lesions did not resemble those in human amœbic dysentery. Rather they resembled those described by Brumpt as caused by *E. dispar* in the kitten. They were, however, more intense.

(5) Emetine must be employed, if at all, with caution. Probably better results will ensue from saline treatment and the administration of some specific *per os*.

(6) In view of the high incidence (probably 10 per cent) of carriers of *entamœbæ* among menial personnel, and of the apparent susceptibility of hounds to infection with certain strains of human amœbæ, the examination of all "dog-boys" and others connected with packs is strongly advocated. In this way potential sources of infection may be eliminated.

REFERENCES.

[1] Wenyon, C. M. (1926). "Protozoology."

[2] Dobell, C. (1919). "The Amœbæ Living in Man."

[3] Darling (1915). "Entamœbic Dysentery in the Dog," *Proc. Med. Assoc. Isthmus Canal Zone*, vi, 60.

[4] Ware, F. (1916). "The Possibility of Amœbic Dysentery in the Dog, and its Treatment with Emetine," *Journ. Compar. Path. and Therap.*, xxix, 126.

[5] Fischer, W. (1918). "Amœbæ and Dysentery," *China Med. Journ.*, xxxii, 13.

[6] Bauche, J., and Motais, F. (1920). "Sur un nouveau cas de dysenterie amibienne du chien," *Bull. Soc. Path. Exot.*, xiii, 161.

[7] Brumpt, E. (1926). "Quelques faits nouveaux concernant les amibes intestinales de l'homme et leur culture," *Le Bull. Méd.*, xl, 105.

[8] Brumpt, E. (1928). "Differentiation of the Human Intestinal Amœbæ with four-nucleated Cysts," *Trans. Roy. Soc. Trop. Med. and Hyg.*, xxii, 101.

PARALYTIC ACCIDENTS OF ANTIRABIC TREATMENT.

By Major S. SMITH,
Royal Army Medical Corps.

Dr. P. Remlinger, Director of the Pasteur Institute, Morocco (Tangier), has recently published a most illuminating report [1] dealing with those rare but interesting occurrences, the paralytic accidents of antirabic treatment. According to this author, three types of paralytic phenomena may occur during or shortly after the termination of a course of antirabic treatment :—

(1) Paralytic rabies caused by *street* virus (hydrophobia).

(2) Paralytic rabies caused by *fixed* virus (*rage de laboratoire*) due to the inoculation of attenuated, though living virus; this is true rabies modified by its passage through a series of rabbits.

(3) The so-called paralytic accidents of antirabic treatment, the subject of this paper, concerning the ætiology of which little is known, but which are generally considered not to be due to rabies virus.

Description of Methods of Preparation of Antirabic Vaccine and of their Influence on the Incidence of Paralytic Accidents.

Before proceeding further, it might be as well to explain the essential difference between the terms "street" and "fixed" virus, which are constantly referred to throughout this article.

By street virus is meant the virus responsible for hydrophobia in man, and rabies in other animals, usually due to accidental contact with a rabid animal.

By fixed virus is meant street virus which has becomed modified in certain particulars as a result of its passage through a series of rabbits or other animals (goats, etc., are sometimes used).

If rabbits be inoculated intradurally with an emulsion prepared from the brain or spinal cord of an animal that has died of rabies (due to so-called street virus), and if successive inoculations from the medulla of this rabbit be made into other rabbits, and so on, the virulence is increased by the successive passages, so that a stage is reached when the infected rabbits develop rabies after an incubation period of about six days, dying within ten days.

The virulence cannot be increased beyond this point, and the virus is then called fixed virus. The pathogenic power of this virus is also changed, so that it is not likely to cause rabies if injected subcutaneously.

It is from cords containing this fixed virus that the vaccine is prepared for antirabic treatment, a variety of methods for its actual manufacture being in vogue at the various institutes.

Thus, in the original Pasteur method, still adopted in many Continental institutes and in America, the spinal cord of the rabbit, which has died from fixed virus rabies on the ninth day after inoculation, is removed and dried over caustic potash at a temperature of 23° C. for varying periods, from three to twenty-one days, and from these dried cords the emulsions are made. Emulsions prepared from cords dried for a relatively short period (three to five days) still contain living though attenuated virus, and it is in the forms of treatment prepared from this source that paralytic accidents are most likely to occur. (The "Hogyes" method, in which fresh virulent cord is injected, has been responsible for a large number of paralytic accidents.)

Various methods for destroying the virus (carbolic acid, Semple), (weak formaldehyde solution, Cumming), have been adopted, and, whereas authorities are by no means unanimous that these modifications are as efficacious in the prevention of hydrophobia as the older methods, there is no gainsaying the fact that patients treated by them are far less liable to paralytic accidents. Thus, at Kasauli, five cases of paralysis occurred among 8,435 persons treated with vaccine made from dried cord; whilst after the introduction of carbolized vaccine by Major Semple, R.A.M.C., the first Director of the Pasteur Institute, Kasauli, only three similar accidents occurred among 84,844 persons treated.

Remlinger sums up the situation as follows:—"The superiority of certain methods of attenuation (methods of Semple and Calmette), the inferiority of others (dried and diluted cords), are not sufficiently marked in the statistics to render it obligatory to adopt the former and condemn the latter methods. Paralyses only constitute one side of the question of antirabic treatment. Whatever method of vaccination is used, it is essential to begin treatment with a much attenuated virus and only gradually to reach the stage of virulent cords."

Not only is the method used in the preparation of the vaccine important, but also the *intensity* of treatment, which varies according to the site, severity and number of wounds inflicted by the biting animal, wounds on the face and fingers being especially dangerous and requiring a prolonged and intensive course.

With these points in view, patients (in India) are now divided into four classes, the treatment given being in a rising scale of intensity from Class 1 to Class 4. The four classes are as follows:—

Class 1.—Cases not bitten, but in which the saliva of a rabid or a suspected rabid animal has come in contact with fresh cuts or abrasions.

Class 2.—Superficial, but not extensive bites on the trunk and extremities (excluding the fingers).

Class 3.—(*a*) All superficial bites on the fingers. (*b*) Superficial, extensive bites on all parts of the body except the head and neck. (*c*) Deep, but not extensive bites on all parts of the body except the head and neck.

Class 4.—(*a*) Deep, extensive bites on all parts of the body. (*b*) All bites and scratches on the head and neck.

Cases in the first two categories only are treated at the Rawalpindi District Centre, carbolized vaccine being used; the more prolonged and extensive treatment for categories 3 and 4 being carried out at Kasauli.

Pathogenesis.

The pathogenesis of the accidents of treatment is at present obscure, and, while many theories as to their causation have been advanced, no very convincing proof has yet been brought forward in support of any one of them.

Amongst other theories may be mentioned the following:—

(1) They are due to the injection of fixed virus.

This theory would appear to be supported by the undoubted fact that paralytic accidents are least common, following or during those treatments in which the virus has been destroyed (Semple's carbolized vaccine, etc.), and most likely to occur when virulent virus is injected (Hogyes' method).

(2) Street virus, modified and attenuated, is responsible.

That this theory is untenable in at least some cases is shown by the following facts: (*a*) Negri bodies have never been found in the brains of those dying from the disease. (*b*) Typical cases of paralysis have been recorded by Remlinger and others in which individuals who have undergone antirabic treatment have contracted one or other of the varieties of paralytic sequelæ of treatment without ever having been in contact with a rabid animal; notably, the case of a school teacher who underwent the course to reassure her pupils, some of whom had been bitten; and of a young man who also undertook the treatment to encourage his fiancée, who had been bitten by a rabid dog. Both the school teacher and the young man developed typical paralysis.

(3) The condition is due to rabies "toxin" elaborated by the virus, which is not itself injected (Babes).

An attractive hypothesis, difficult to prove or disprove in the present state of our knowledge.

(4) An adventitious microbial infection, incidental to the passage rabbit, injected along with the vaccine.

(5) A poison of normal nerve substance (Marinesco).

(6) A filtrable neurotropic virus, other than rabies, occurring in rabbits.

This theory has much to recommend it, and has been advanced to account for the somewhat similar encephalomyelitis (more often a frank encephalitis) which occasionally follows vaccination against smallpox with leporine vaccine.

(7) A dormant infection (virus or microbial), in the individual injected, is "fanned into flames" by the vaccine.

This theory was held by the recent Ministry of Health Committee on vaccination to fit in best with the encephalomyelitis that occasionally follows vaccination.

Clinical Varieties.

Whilst admitting that the "Accidents of Treatment" fall into many groupings, Dr. Remlinger was able, from a study of 329 cases presented to the International Rabies Conference held at Paris in 1927, to classify them into three main types.—

(1) Landry's Ascending Type.

The most fatal of the three, with a case mortality of thirty per cent. Onset, seventh to fourteenth day of treatment, sometimes after cessation of treatment. Sometimes preceded by a history of chill. Onset sudden. Patient rapidly develops high fever, headache, vomiting, and a dorso-lumbar backache, followed rapidly by marked paresis of the legs, which rapidly become completely paralysed, retention of urine, retention of fæces, less commonly incontinence. A few hours later intense girdle pains develop in the chest and throat, followed by darting pains and tingling in the upper limbs, which may also become completely paralysed. Pain in the muscles of the face is followed by paralysis of the muscles of the neck, face and tongue, with various bulbar troubles.

The patient either dies from involvement of the higher centres in the bulb, or recovers the use of his limbs in the reverse order to that in which they were attacked. Recovery is usually complete in a few days, but weakness may persist for a much longer period.

(2) Paralysis of Dorso-Lumbar Type.

An intermediate group with a case mortality of 5 per cent. The onset is marked by slight initial fever rapidly followed by paresis, and later paralysis, of the legs. The toes are not moved at all, or only with the greatest difficulty; subjective sensations of tingling and numbness of the legs occur early; all forms of cutaneous sensibility are much diminished; there is a plantar extensor response; early retention of urine, requiring catheterization, and of fæces are the rule; girdle pains are complained of in the chest; there is complete absence of bulbar symptoms. After a few days recovery usually commences, and is usually complete in a few weeks. Occasionally, recovery may be delayed for several months, in which case certain trophic disturbances, such as bedsores, cystitis, etc., are liable to occur.

In some cases, much less severe, mild paresis of the lower limbs only, or combined with slight retention of urine and fæces are the sole symptoms; these mild cases tend to occur later, following cessation of treatment, than the more severe.

(3) Neuritic Types.

Mortality, nil. The peripheral nerves only are attacked. Uni- or bilateral facial paralysis is especially likely to occur, often accompanied by oculo-motor palsy or glosso-pharyngeal weakness. Cranial nerve paralyses may be accompanied or replaced by neuritis of the radial nerve, sciatic nerve, etc., often with slight retention of urine. These peripheral nerve paralyses usually occur after completion of treatment, occasionally many weeks after.

The characteristic features of the paralyses following antirabic treatment are, according to Remlinger:—

(1) The frequency of Landry's syndrome.
(2) The common involvement of bladder and rectum.
(3) Involvement of the facial nerve in many cases.
(4) The usually favourable prognosis.

Of a series of 243 instances of paralytic accidents, there were: 39 (16 per cent) cases of Landry's paralysis; 122 (50·2 per cent) cases of dorso-lumbar paralysis; 82 (33·7 per cent) cases of neuritis, the facial nerve being involved alone or with others in 67 (82 per cent) of the neuritic cases.

The percentage of the neuritic cases is probably much higher than that given, as many mild cases would have failed to report.

(*Note.*—The above account of the clinical varieties with statistics is copied almost verbatim from Dr. Remlinger's report.)

Pathology.

With regard to pathological findings there is little that is characteristic. According to Babes and Marinesco, who have made a careful study of the post-mortem appearances, the chief lesions are to be found in the dorso-lumbar region of the cord, the grey and white matter being attacked alike and both transformed into a pinkish grey pulp. Various changes are found in the nerve-fibres, their axis cylinders are swollen or have actually disappeared. The vessels show various changes, none of them characteristic; and, most important of all, Negri bodies have never been found in the positions characteristic of rabies or elsewhere.

Incidence.

In an analysis by Remlinger of cases from 49 Pasteur Institutes, 329 cases of paralysis were reported out of a total of 1,164,264 individuals who received antirabic treatment, or 1 in 3,538 (0·028 per cent).

The incidence varied greatly in the various institutes, some showing an incidence as low as 1 in 25,000 to 1 in 28,000, others as high as 1 in 259 to 1 in 400 per persons treated.

Other Ætiological Considerations.

(1) Europeans are said to be much more commonly affected (so far as India is concerned) than the native population.

Whilst this generalization may be true, it must not be forgotten that a much larger proportion of such accidents are reported in the case of Europeans, who are usually within skilled medical reach, than in the case of Indians, most of whom belong to the poorest "villager" class, returning to their villages directly the treatment is over, far out of reach of medical aid other than that afforded by the village "hakim."

(2) Young children are rarely, and children under five apparently never, the victims of paralytic accidents.

(3) Those engaged in hard intellectual work, such as authors and the professional classes, more particularly those who lead a sedentary life, are especially liable to attack.

Prognosis and Treatment.

The prognosis in these cases is usually favourable, considering the severe nature of the initial paralysis, a global mortality of 16·85 per cent being reported (Remlinger).

In only a small percentage of cases is recovery from the initial paralysis incomplete, paraplegia and distressing contractures being met with. The patient may recover from the paralysis to die later from septicæmia, the result of bedsores or of an ascending pyelitis.

Complete recovery may, however, take as long as six months. Treatment should be palliative and symptomatic. There is a natural tendency to cure, and until we are better informed as to the causation of the disease, heroic medication of any kind is out of place and may be dangerous.

Differential Diagnosis.

In most cases the only real difficulty in diagnosis lies between the symptom-complex of accidents of treatment and true hydrophobia, caused by street or fixed virus.

The symptoms may be very similar in the two diseases, the chief points of difference being:—

(1) Hydrophobia is invariably fatal, whereas a global mortality of only 16·85 per cent occurs in the case of paralytic accidents.

(2) The incubation period of hydrophobia is less constant than that of the more severe examples of paralytic accidents, being usually thirteen to fifteen days in the latter.

(3) Mental and bulbar symptoms, often accompanied in the terminal phases by clonic spasms, are common in hydrophobia, whilst the mind is usually clear to the end in paralytic conditions.

(4) In the case of death from hydrophobia, injection of brain emulsion (from the hippocampus major or bulb) into the brain of a rabbit or other susceptible animal, will almost invariably produce rabies in the animal injected, and in a large proportion of cases (over 90 per cent) Negri bodies (small in the case of fixed virus rabies, $0{\cdot}5\mu$ or less, large in the case of street rabies, $18\text{-}23\mu$) will be found in its brain at autopsy. In many cases, also, Negri bodies will be found in smears taken shortly after death from the hippocampal region of the patient's brain.

(5) Paralytic accidents are rare in children and almost unknown in those under five years of age, while hydrophobia occurs in its due proportion at all ages.

(6) Hydrophobia is most common following severe bites (especially in the head and neck regions), whilst the severity of the bite (except in so far that the treatment is more intensive) has no effect on the incidence of the paralytic accidents, which have been known to occur when the individual has not been in contact with a rabid dog.

In spite of these differences the diagnostic difficulties between the two conditions may be great, and Remlinger stresses the fact "that the history of the case, especially with regard to the gravity of the bite, likelihood of rabies in the biting animal, time elapsed since the bite, since the beginning of treatment, since the injection of the first virulent cord (if living virus be used), are more important in coming to a decision than a consideration of the symptoms which may be so alike in the two diseases."

Comparison with other Forms of Myelitis.

In addition to the above, acute myelitis, more usually encephalomyelitis, may be met with, during the course of, or shortly after, many of the acute specific fevers, notably smallpox, measles, chickenpox, scarlet fever, diphtheria, whooping cough, and mumps.

Turnbull and McIntosh have recently reviewed the literature dealing with myelitis following smallpox, and divide their cases into three clinical groups: (1) Those with bulbar symptoms. (2) Those with bulbar symptoms and paralysis of the limbs. (3) Those with paralysis of the limbs accompanied by paralysis of the bladder and rectum.

It is this third group which resembles, clinically at any rate, the dorso-lumbar type of paralytic accident associated with antirabic treatment.

In the forms of encephalitis and encephalomyelitis following the other acute fevers, signs of meningeal involvement are common, but the cord alone may be involved, whilst in some (notably syphilis and whooping-

cough), an acute vascular lesion, hæmorrhage or thrombosis, is held to be responsible.

In the variety of myelitis following mumps, meningitis, encephalitis and polyneuritis are most commonly met with.

In addition, an idiopathic variety, known as acute disseminated myelitis, has been described, and has recently received considerable attention. The possibility of this latter variety being an aberrant form of disseminated sclerosis is still under discussion.

Of recent years special attention has been drawn to the occasional occurrence of myelitis (more commonly encephalomyelitis) following vaccination with cowpox virus against smallpox. Although the symptoms commonly found in patients suffering from the two conditions (paralytic accidents of treatment and post-vaccinal encephalitis) are not identical, they have many points of similarity.

Rabbits are usually employed to "passage" the virus in both cases. In fact, in the case of post-vaccinal encephalitis or encephalo-myelitis it is only since the introduction of this method of preparation that any considerable series of cases has occurred; and some have even suggested that rabbits should cease to be used as passage animals on this account.

TABLE I.—SOME POINTS OF SIMILARITY AND DISSIMILARITY BETWEEN POST-VACCINAL ENCEPHALITIS AND PARALYTIC ACCIDENTS OF ANTIRABIC TREATMENT.

Post-vaccinal Encephalitis.	*Paralytic Accidents of Antirabic Treatment.*
1. Leporine vaccine used.	1. Leporine vaccine.
2. Incubation period— Extremes, 9-19 days Usual, 10th-12th days.	2. Incubation period— Extremes, 10-30 days. Usual, 13th-15th days.
3. Most common in children.[1] (Vaccination most commonly performed at this age-period.)	3. Rare in children. (Almost unknown under 5.)
4. Three chief clinical types— *a.* Brain stem alone. *b.* Brain and spinal cord. *c.* Spinal cord alone. (Little meningeal involvement.)	4. Three chief clinical types— *a.* Landry's ascending type. *b.* Dorso-lumbar type. *c.* Neuritic types. (Little meningeal involvement.)
5. Convulsions, trismus, etc., common.	5. Convulsions and trismus rare.
6. Vesical and rectal disturbances common.	6. Bladder and rectal symptoms the rule even in mild cases.
7. Mortality (in one large series) 58 per cent.	7. Global mortality 16·85 per cent. (30 per cent in Landry's type.)
8. Sequelæ uncommon in those who recover from acute stage.	8. Sequelæ uncommon.
PATHOLOGICAL FINDINGS.	
9. Most intense changes ln lumbar and sacral regions of cord.	9. Dorso-lumbar region chiefly affected.
10. Both white and grey matter affected.	10. Ditto.
11. Perivascular spaces show marked infiltration with lymphocytes, plasma cells, etc.	11. Ditto.
12. Findings to date suggest "virus" disease.	12. Ditto.

[1] *Editor's Note.*—According to the report of the Ministry of Health Committee on Vaccination, encephalitis is rare in young children and more common at school age and in adolescents.

Important points of similarity are therefore :—

(1) The incubation period.

(2) Common involvement of bladder and rectum.

(3) Complete recovery in those who survive the acute stages.

(4) Rapid onset.

(5) Definite relationship to vaccination.

(6) Leporine vaccine commonly used in both.

(7) Most marked changes in dorso-lumbar region of cord.

(8) " In paralysis complicating antirabic treatment, the pathological changes appear to be identical with those of post-vaccinal encephalitis." [2]

Acting on the reasonable assumption that in both post-vaccinal encephalitis and the paralytic accidents of treatment, the symptoms are due to the same or a closely-allied neurotropic virus or toxin occurring in the rabbit, it is suggested as a working hypothesis that the slightly different symptomatology in the two diseases (i.e., esssentially an encephalitis or an encephalomyelitis in the one, a myelitis or neuritis in the other), may be to some extent governed by the site of introduction of the vaccine, namely, the arm in the one, the abdominal parietes in the other.

The difference in the site of injection may also determine the slightly shorter incubation period and higher mortality in the case of post-vaccinal encephalitis.

In this connection it would be interesting to know (I can find no allusion to it in the scanty literature at my disposal) if either or both affections are more likely to occur in those who suffer from a severe local or general reaction whilst under treatment.

In the only case of paralytic sequela within my experience, the patient, who was undergoing a mild " lick " course, had an unusually severe local reaction, his abdominal wall being red, raised and " lumpy " during the antirabic course (see Case 1).

Many views are held as to the pathogenesis of encephalitis following vaccination against smallpox. The recent British Committee on vaccination, after reviewing various theories, has come to the conclusion that the activation of some neurotropic virus, previously lying dormant in the individual vaccinated, by the vaccine, best fits in with all the known facts, but admits that this view is little more than a hypothesis.

It is generally concluded that the virus or viruses responsible for encephalitis lethargica and acute anterior poliomyelitis are similar but not identical with that of post-vaccinal encephalitis. Can the accidents of antirabic treatment be ascribed to a similar activation?

All the above theories have serious and obvious defects, and the pathogenesis of the whole range of " myelitic accidents " must be held for the moment not proven.

Two cases, illustrative of some of the points raised in this article, have been admitted to the British Military Hospital, Rawalpindi, during the past few months ; both are considered sufficiently uncommon to warrant brief descriptions :—

Case 1.—Major W. was admitted on March 16, 1930, complaining of fever, pain in the back, numbness of both legs, and difficulty in micturition; he gave the following history:—

He received a seven days' "lick" course (Class 1) at the antirabic centre, Rawalpindi, completing the course on March 10. During the course a severe local reaction occurred in the abdominal parietes at the site of each injection, large, raised, red and painful lumps appearing. That this unusually severe reaction was due to personal idiosyncrasy and not due to any fault in the technique of injection or preparation of the vaccine, is proved by the fact that several other individuals, including his wife, were daily receiving injections from the same "brew" and even from the same phial without any local reaction. He had undergone a previous antirabic course in 1917 at Kasauli, which was accompanied, also, by a severe local reaction but followed by no sequelæ.

The patient first felt feverish on March 13 (ten days after the first injection), since when he had had an almost continuous pyrexia in the neighbourhood of 102° to 103° F., until the day of admission. Severe pain in the dorso-lumbar region of the spine, partial numbness of both legs, and difficulty in urinating were first complained of on March 15.

When examined on the morning of admission, no objective sensory loss could be detected in either leg, and their movements appeared normal; knee- and ankle-jerks were present and both plantar responses were flexor. From March 16 to 18, increasing difficulty in micturition was noted, and by the latter date complete retention of urine had set in, requiring catheterization twice daily. By this date there was almost complete paralysis of both legs, slight voluntary movement of the toes alone being possible. The knee- and ankle-jerks were now absent but the plantar responses were still flexor; there was also some degree of paræsthesia of both legs, a pin prick being felt but not appreciated as such. A complete transverse band of hyperæsthesia had developed, enveloping the trunk from the umbilical level above to the region of Poupart's ligament below; the merest touch with a handkerchief or cotton-wool over this area caused him acute discomfort. The Wassermann reaction was negative.

For a month there was little change in his general or local condition, and a very guarded prognosis was given.

A mild degree of cystitis developed, followed by pyelitis with a swinging hectic temperature, and his cardiac condition at times gave cause for anxiety; two superficial bed-sores also appeared but rapidly healed.

Flatulence and obstinate constipation of the spastic type were disturbing and very annoying features; the latter was best treated by an injection of ½ grain of pituitrin followed 15 minutes later by a glycerine or soap-and-water enema, this assuring a satisfactory action of the bowels every other day.

An alarming feature during the first week following admission was that the hyperæsthetic area on his trunk gradually shifted upwards, suggesting

an upward extension of the acute process, and eventually became an acute girdle pain encircling his lower costal region and causing him much discomfort and respiratory distress.

Improvement in the local and general condition set in about a month after admission, since when slow but steady progress has been maintained.

At the present time a large amount of voluntary power has been regained in both legs, more advanced in the left than the right. There is slight general spasticity of the right leg with increased knee- and ankle-jerks, ankle clonus, and definite plantar extension; slight flexor and adductor spasms have worried him recently, especially at night. The general appearance and condition of the patient are now satisfactory, and his temperature has been normal for a month or more. The hyperæsthetic area on the trunk has long disappeared.

Presumably, the eventual prognosis in the case of this officer is excellent, and complete recovery is to be expected.[1]

Further interesting points in his history are that he is inclined to intellectual pursuits, is an author of some repute, and is not interested in sport. At the time the paralysis occurred he had only been married a few months.

It is interesting to note that this officer's wife, who received an antirabic course with her husband, complained of intense neuralgic pains in the head necessitating complete rest in bed, about a week after her husband developed his paralysis; whether these pains, which she describes as more intense than any she has ever had, were due to natural anxiety at her husband's condition, or were a mild form of the neuritic type of paralytic accident, it is difficult to say. In her case the symptoms, which included a quite noticeable temporary aggravation of an old Bell's palsy, subsided in a few days.

The above is, it is presumed, a fairly typical example of the dorso-lumbar type of paralytic accident occurring after antirabic treatment in a man of sedentary habit engaged in intellectual pursuits.

One wonders if such accidents are more likely to occur in those who, like Major W., suffer from an unusually severe reaction during the injections.

It is interesting to conjecture how far, if at all, the previous antirabic course he had undergone played any part in the causation of the myelitis following the second course. Whether, in fact, the paralysis was part of an anaphylactic reaction, following a "summation of allergic insults" in the shape of the daily injections.

---

[1] *Editors' Note.*—We are indebted to Major R. Priest for further particulars of the progress of this case. Under treatment by radiant heat and massage his condition continued to improve. On December 1 it was reported that he had made very good progress and could walk very much better. Sensations to light touch and pin-prick were accurate over both legs. Joint sense and vibration sense were still impaired. Bladder and bowel control had improved. The skin over the lower third of the legs was still glossy and slightly œdematous.

Case 2.—Lance-Cpl. B. was admitted on April 11, 1930, and gave the following history :—

He was bitten by a rabid dog (Negri bodies found in dog's brain at autopsy) on the cheek on March 11, 1930. He was sent to Kasauli, where he received a full "Class 4" course of antirabic treatment.

On his way back from Kasauli, on April 9, 1930, he complained of headache and fever, and was admitted to hospital on his return with the provisional diagnosis of sandfly fever, which was prevalent at the time and which his case very much resembled.

On admission, his only complaint was of slight pain at the back of the head and neck; his temperature was 104° F., his face suffused, eyes injected and pulse rapid; blood-slides were negative as regards malaria.

By the following morning his condition was much worse, his face was markedly flushed, there was some degree of slurring dysarthria, and he had developed a very noticeable squint and complained of diplopia. There was also slight stiffness and pain in the back of the neck.

His condition rapidly deteriorated, speech became more incoherent and rambling, he developed chronic spasms of the hands and feet, commenced to froth from the mouth, and died two days after admission, four days after the onset of symptoms, and one month after being bitten; death was preceded by a sudden rise of temperature to 105·2° F., and immediately followed a short generalized convulsion, the first he had had.

Smears taken from the hippocampal region shortly after death showed no Negri bodies.

Emulsions of hippocampal tissue were injected into the brains of two rabbits, both of which developed symtoms of rabies on the sixteenth and seventeenth days respectively after inoculation.

Negri bodies (large type) were found in smears from the hippocampal region of these rabbits.

Thus, in the case of Lance-Cpl. B., we have the absolute proof by animal inoculation that he died of hydrophobia (probably street rabies, on account of the large size of the Negri bodies), and not from a severe type of "paralytic accident."

Other points, less conclusive, in the history and clinical course of this patient suggesting the diagnosis of hydrophobia rather than "paralytic accident" were :—

(1) The biting dog was proved to have been rabid (Negri bodies found in smears from brain).
(2) The patient was bitten on the cheek, an admittedly dangerous site, followed by a high proportionate mortality from rabies.
(3) The signs and symptoms did not fit into any of the three clinical groupings described by Remlinger as characteristic of paralytic accidents of antirabic treatment.
(4) Early involvement of cranial nerves, squint and diplopia, and of

the bulb, dysarthria, with early mental symptoms, are more characteristic of rabies than of paralytic accidents.

(5) The rapid death of the patient preceded by tetanic spasms and clonic convulsions characteristic of hydrophobia.

In conclusion, my thanks are due to Major A. C. Craighead, I.M.S, Officiating Director of the Pasteur Institute of India, Kasauli, to whose kind offices I am indebted for the loan of the monograph by Dr. Remlinger dealing with the accidents of antirabic treatment; he also materially aided my inquiry by successfully inoculating rabbits with portions of brain tissue from Lance-Cpl. B. sent to him in glycerinated solution, and afterwards demonstrated the presence of Negri bodies in smears from the brains of these rabbits. My thanks are also due to Major C. H. K. Smith M.C., R.A.M.C., D.A.D.P., Rawalpindi District, who carried out the autopsy on Lance-Cpl. B., and who also successfully inoculated rabbits with rabies virus from his brain; and last, but not least, I owe a debt of gratitude to Dr. Remlinger, Director of the Pasteur Institute, Morocco (Tangier), without the constant help of whose excellent report this article would never have been written.

REFERENCES.

[1] League of Nations Report to the International Rabies Conference held at the Pasteur Institute, Paris, 1927.

[2] Papers read by H. M. Turnbull and James McIntosh in a discussion on Encephalo-myelitis in Virus Infections, before the Section of Pathology and Bacteriology, at the Annual Meeting of the British Medical Association, 1928 (*Brit. Med. Journ.*, August 25, 1928, pp. 331-336).

REFRACTIVE ERRORS IN THE SOLDIER AND THEIR TREATMENT.

By Major J. P. LITTLE,
Royal Army Medical Corps.

The views on treatment advocated in this article are those of the writer, and should not be taken as an authoritative statement as to the treatment of refractive errors in the Army.

The soldier, like his brother in civil life, may, for optical purposes, be in one of three classes: the emmetropic, the hypermetropic, and the myopic, with their astigmatic variations.

We are often asked why we have not given glasses to Private So-and-So, and it is the purpose of this article to try and answer that question for the benefit of the medical officer in charge of effective troops, who is harassed by a company commander with an unduly large percentage of third-class shots.

With regard to the first class, the emmetropic, or normal-sighted, little need be said, except to comment on the relative rarity of perfectly normal vision.

The hypermetropes and hypermetropic astigmatics comprise by far the larger proportion of those who come within the purview of the ophthalmic surgeon, and also include a vast number of serving soldiers who, during their time with the colours, never feel the need for any aid to their eyesight.

The myopes in the Army, and in civil life, are a much smaller class; and it will be found convenient in this article to consider them first, as their needs are perhaps the most urgent, and are certainly the most simple and easily met.

Myopia or short sight is, roughly speaking, a condition in which the axis of the eyeball is too long for rays to be brought to a focus exactly on the retina.

The present standard of vision on enlistment is such that only myopes with a low degree of myopia (up to 1·5-2 dioptres) are able to pass the visual examination at enlistment, so that, as far as troops are concerned, the difficult questions that are met with in dealing with high grades of myopia do not arise. The myopic soldier's problem is simple. For all near objects his vision is clear and good. He does not get headaches but, when he goes on the range, he cannot see the target clearly, perhaps not at all. He cannot recognize his officers across the barrack square; he does not see the actors at the pictures unless he gets a front seat. With these disabilities it is obvious that it is usually early on in his career that

he is sent to the eye specialist ; and in simple myopia it will be found that the prescription of a low concave lens will relieve him of all his troubles. Such glasses are always worth while prescribing; a low myope puts on his correcting spectacles and immediately looks through them on to a new world. Objects that before were indistinct now stand out clearly. He has no trouble in accommodating himself to the new glasses, he can put them on and off in the same way that we can use a pair of field glasses ; and in taking them off suffers no derangement of his former vision. He has no need to wear them on parade, or when walking out, so that neither his vanity nor the feelings of his company officer or C.S.M. are in any way affected. He wears them when he needs them and not otherwise.

Add to this the fact that the myope sees very poorly in the dark and, therefore, is at a great disadvantage as a sentry, and it will be seen how greatly he is helped by his proper glasses.

Before finally dismissing the myope, one might add that, for some reason not fully understood, the low grade myope is almost always of a fairly high grade of intelligence. In the public school classes this may be explained perhaps by the fact that his eyesight makes him inept at games and, therefore, he is driven to books ; but this hardly applies to the class recruits are drawn from.

The facts which apply to the myopic soldier apply in slightly lesser degree to the man with myopic astigmatism. His refractive error will be a very low one ; it may cause headaches, but probably not while he is employed on ordinary duties. He, too, is well worth his pair of spectacles.

When we come to consider the hypermetrope, and the hypermetropic astigmatic, we are faced with a very different state of affairs. In hypermetropia, or long sight, the eyeball is too short and rays of light are brought to a focus behind the retina ; owing, however, to the accommodative power of the lens this can be successfully concealed.

The hypermetrope looking at the test types at twenty feet is in the same position as an emmetrope reading a book at two feet. He has to accommodate, that is, he has to alter the shape of his lens, making it more convex, to focus the letters clearly. The same applies to more distant objects in the higher grades of hypermetropia. In the young this power of accommodation is very great and remains at a high level in the young adult, gradually diminishing, till at the age of 40 to 45 the condition of presbyopia is reached, when it is necessary to supply a small convex lens to help the eye to read at normal distance (two feet).

In the Army at any rate, I think most ophthalmic surgeons will agree that there is a wide individual variation in the power of accommodation. In the writer's opinion, as long as the young soldier is not employed on clerical work or signalling, the more intelligent and resolute man appears to score over his more stupid comrades. The normal young soldier under 25 should certainly be able to overcome a simple hypermetropia of 2 dioptres,

and in many cases a considerably higher degree for all purposes of ordinary duty. I have known several men who were marksmen with a hypermetropia of 4·5 or 5·0, and who only experienced any trouble with their eyes on reaching 30 years of age, or when they attained the rank of C.S.M. with its attendant clerical duties.

This power of accommodation is, however, liable to a great falling off under any circumstances which throw an undue strain on the individual, such as ill-health, worry, climate, etc., and it is a common experience in India to find a soldier's eyesight decline from $\frac{6}{6}$ to $\frac{6}{18}$ within twelve months of his arriving in the country.

The cases of hypermetropia which the ophthalmic surgeon sees fall into two distinct groups, which for the most part require different consideration and treatment.

In the first group are those who report sick on their own initiative, chiefly for headaches. This group will be found to consist mainly of men who have recently been employed as clerks, or who are working for examinations, or signalling, or occasionally of old soldiers who are marksmen and find that they can no longer see to shoot properly.

The second group consists mostly of young soldiers who are sent off the range by their company commander, as they cannot hit the target, and a few older men who are third-class shots, and whom the C.O. wishes converted into first-class shots. The men in this group, unlike the first, make no complaint of any symptoms.

The treatment of these two sections of hypermetropes raises very different and much more difficult questions than the treatment of myopes.

Owing to his power of accommodation, the young hypermetrope unconsciously treats his own condition and, in consequence of this habit, is frequently unable to relax his accommodation fully when his correcting lens is supplied, with the result that the correcting lens plus his own accommodation render him temporarily myopic and makes his vision less keen than it was without any glass at all.

It is only by wearing his glasses constantly that he will learn to relax his accommodation sufficiently to get the benefit of them. Unlike the myope, he cannot use his spectacles as field glasses and take them on and off quite happily. These remarks, of course, apply only to the wearing of spectacles for distant objects. For near work, the hypermetrope will always feel the benefit of his correcting glass, though he may not be able to tolerate his full correction at first, owing to his inability fully to relax his own accommodation.

What then is the ophthalmic surgeon to do for these hypermetropic cases ?

Group I is fairly simple. Those employed in clerical work should be given the strongest correcting glass they can tolerate up to their full correction; if they cannot tolerate full correction at first, the power of the lenses can be increased in six months' time. The warrant officer type will take his

full correction for near work and may require a distant glass as well. These are not supplied by the Army, but he will generally purchase his own.

The signaller falls into a different category for treatment, and for the reasons advanced in dealing with Group II the writer has found that it is a better policy to recommend that he be relieved of signalling duties, except in special cases, than to prescribe glasses.

With regard to the men in Group II, one has to consider the following points :—

(1) The man has no symptoms and, as far as he knows, no disability.

(2) It is quite possible for a man to be a marksman with 4·5-5·0 of hypermetropia.

(3) Other factors than those of eyesight are involved in the production of a good shot; muscular co-ordination, adequate cerebration, keenness, etc.

(4) A healthy young soldier ought to be able to overcome a refraction error of at least 2·5—3D without strain while employed on ordinary duty.

(5) His ordinary duties do not involve any eye-strain.

(6) The provision of glasses is allowed by Regulation only to increase a man's efficiency, not to assist him to gaze at Miss Greta Garbo or help him in his studies of the more lurid Sunday journals in his off-duty time.

(7) The glasses to be of benefit must be worn constantly.

(8) We may be quite sure that his own vanity and the concern of his C.S.M. and company commander for the smartness of the company will conspire together to prevent his wearing his glasses constantly.

Bearing these facts in mind, it will not be difficult to arrive at the conclusion that it is hardly worth while to provide a symptomless soldier with glasses that will only benefit him if worn constantly, the more especially as it is very doubtful in most of these cases whether the soldier's inefficiency as a shot is caused by defective vision.

The observations that apply to hypermetropia apply similarly to hypermetropic astigmatism, except that a lower degree of defect will involve a greater degree of disability, and will cause symptoms in soldiers performing ordinary duties.

It is therefore advisable in these cases to correct all but the lowest degrees, and to attempt to ensure the constant wearing of the glasses; though again it will be found that many natural forces conspire to prevent this, and that personal vanity will prefer headaches to spectacles, and inefficiency to the jest of the barrack-room.

To sum up, the provision of spectacles to the myopic soldier is always desirable; to the hypermetrope it is desirable only in certain cases. In the majority of the cases of young soldiers who are sent to the ophthalmic surgeon because they are third-class shots, it is a waste of public funds to prescribe spectacles to correct their refractive error.

SOME ASPECTS OF SPECIALIZATION AND RESEARCH IN THE SERVICES.[1]

By Surgeon-Captain SHELDON F. DUDLEY, O.B.E., R.N.

It is becoming more and more obvious that no one man can master more than a fraction of the accumulated knowledge, or have time to acquire the technical ability necessary for the efficient practice of more than one or two of the numerous subdivisions of applied medical science. Specialization or division of labour solves the problem to some extent. And the time seems near when the general practitioner will be the most important specialist of all, with the chief function of informing patients to which experts to go. To perform this duty adequately he will require a far wider knowledge than anyone who specializes on a single organ of the body. This may be feasible ashore in areas where the population can support a team of medical men, but in the Services the all-round medical man is still required, especially in ships and isolated districts with small populations.

Of late years the practice and study of medicine is developing more as a science than as an art. The pose of confident omnipotence formerly typical of the family doctor has largely been replaced by the diffidence of the student of nature, and the value and necessity of medical research are becoming recognized. As it has been my fortune to have been engaged about equally in general, special and laboratory practice in the Royal Navy, I presume to make a few remarks on these important subjects.

Sir Thomas Lewis [1] recently pointed out that medicine falls naturally into two main divisions—curative and progressive. The former is practically the craft of applied medicine, the latter is research. We can further divide both of these two main divisions into individual and collective medicine—general practice and public health. Public health can be divided into curative preventive medicine, or herd-treatment, and progressive preventive medicine, or herd-pathology. It must be clearly understood there are no watertight bulkheads between these departments of medicine. Anyone who administers a remedy to a patient practises progressive medicine in so far as he notes the sequence of events in a certain type of subject under a specific set of conditions. Lewis draws attention to the divergencies in the method of approach towards pure curative and pure progressive medicine. In curative medicine diagnosis is the main end-point whose object is to recognize the known in order to administer the correct established remedy, if any. The worker in progressive medicine has no interest in the known, except as a starting-point to reach out into the

---

[1] President's Address, United Services Section, Royal Society of Medicine. Reprinted from the *Proceedings* of the Society, Vol. xxiv, No. 2, December, 1930, by permission.

unknown. Secondly, the whole duty of the practitioner of curative and preventive medicine is to do the best for the individual, or the herd, with the knowledge and material at his disposal. To the scientific investigator the individual or community is of no importance or interest, unless as material to help the progress of scientific medicine. In so far as he is allowed any humanitarian interests at all, the researcher works largely for the future, and is glad if during his lifetime any of his work should prove useful in presenting applied medicine with new methods of diagnosis or treatment. Thirdly, there is the difference in the mental attitude of the curative and progressive worker. There is no doubt that from both the patient's and the doctor's point of view, telling the literal truth to patients is incompatible with sound medical therapeutics. If we always confessed to the truth that is in us, we should often have to say to our patient, "I do not know what is the matter, I do not believe the treatment I am ordering will do you any good, but hope it will not do you any harm, and make you more comfortable," and, paradoxical as it may seem, the more widely read a doctor is the more often he finds himself in this position. Pedantic honesty in a practitioner of curative medicine is a selfish luxury and bad practice, and may account for some of the bad reputation Service medicine used to have among certain ignorant or misinformed circles. Francis Bacon has said: "To pronounce disease incurable is to establish negligence and carelessness as it were by law, and screen ignorance from reproval." And, however much a practitioner realizes his ignorance, it is an essential part of therapeutics to deceive the patient as to the fact. More, the fact itself should never be an excuse for the neglect of patients, but a continual spur to find out what little is really known in order to place it at his patient's disposal, and to make certain he does not miss one of the many conditions in which he can help Nature, or that he does not destroy the only remedy which is helpful in every malady—confidence in the doctor. On the other side progressive medicine is science, and science is the definition of truth. As Lewis [1] says:—

> "The very essence of daily observation and thought in scientific work is the continual effort to discriminate as closely as possible between what is true and what is less true or actually false. The standard of truth attained by constant and deliberate cultivation among scientific men in their work greatly transcends that in any other sphere of human thought. It is a standard that allows no statement to pass without full qualification, without full display of its limitations. It is a standard essential to progressive work, but one highly inconvenient and even obstructive in the practice of everyday life."

The qualities required for the pursuit of progressive and curative medicine are so divergent as to make it seem improbable they can be successfully blended in one individual. Nevertheless, the plasticity of the mind is such that it is possible, and I speak from experience, to enter a

ward, be convinced that a case is one of influenza, prescribe aspirin with certainty that it will be efficacious, and confidently assure the patient that he will be well in a week. Five minutes later the practising investigator is in his laboratory facing what appears to be the only interpretation of drastically controlled experiment, and becomes a flabby mass of indecision and doubt. After all, the difference in mental attitude is only due to a common psychological mechanism, a mixture of dissociation and repression which, unless we are critically introspective at the time, passes without notice, and which many happy men never discover at all.

I think many men can practise both the curative and progressive branches of medicine with success; in fact the long list of practitioners of applied medicine who have made notable contributions to progress indicates that this must be so. However, while certain types of medical research are more easy and fruitful if the investigator is actively practising administrative or curative medicine at the same time, yet the converse does not hold good, and the essentially critical attitude of the scientific investigator does interfere with his ability in the art of managing and treating patients, because it is bound to undermine his confidence in much of his daily work. In fact we all know the type of consultant, whose extensive knowledge so fills him with hesitancy and doubt that he is of little use to the general practitioner who hopes for a definite opinion. Most of us can remember the happy state of mind we were in at the time we qualified. Every statement in our textbook, or uttered by our teachers, was an unimpeachable fact. Our medical education largely consisted of memorizing a medley of facts, theories, opinions and legends, giving to them all an almost equal amount of credence. The relative probability of the truth or falsity of any statement was rarely indicated. To some extent this may have been unavoidable, seeing the mass of detail a medical student must of necessity absorb to practise the profession of applied medicine. One sometimes feels that the medical practitioner should endeavour to remain in this state of mind, by never reading anything but the last edition of his favourite text-book, and believing that every word in it is the literal truth. Many first-class practitioners do, I think, remain in a frame of mind approaching to this, and they and their patients are happier for it. And, as probably more than 90 per cent. of men never recant from the religious, political, or medical creed in which they were brought up, I presume the majority of practitioners are consciously honest, while unconsciously deceiving themselves and their patients.

In addition to the natural divisions of medicine into curative, progressive, individual, and collective, there is the more artificial subdivision into "specialisms." Keith [2] shows how this specialization is the result of the "inexorable law of evolution" which applies to medical practitioners as much as to any other group of organisms. As a result of the growth of medical knowledge, the profession has of necessity to split up into an ever-increasing number of specialists. The advantages of specialization are

evident, but there are also disadvantages. The highly specialized doctor, just as any other highly specialized animal, is closely adapted to only one type of environment, in which he far outshines the more plastic general practitioner, who is, however, much more at home in all other types of medical environment. Under the present system of medical organization and education the practitioner generally specializes too early. In unconscious defence of his ignorance of things outside his own department he sometimes develops an air of superiority over the more generalized doctor, who has to be a wider-read and more adaptable individual or go under. Again, the breaking up of the medical profession into sub-herds, often of differing ideals and customs, has led to a certain amount of friction between the groups, which may hinder progress in some directions while advancing it in others by stimulating healthy rivalry. The following purposely overdrawn incident will show what I mean. When I was doing both ward and laboratory work, an eminent pathologist visited me in the latter environment. I had to excuse myself to go and see an urgent case. When he realized what I was going to do he said, "Good Lord ! man, you do not tell me you actually have to go into the wards and open people's bowels." I shall never forget his tone of pity and reproach ; I felt I had been thrust out of his herd of pathologists. I was a pariah—a clinician.

In certain subjects early specialization seems actually to induce pride in ignorance of general medicine and surgery. The following episode illustrates such a tendency, which should always be discouraged while the subject's mind is still plastic enough to receive impressions. At one of the naval hospitals early in the war, a recently qualified youngster, who had started to specialize, joined up as a temporary surgeon lieutenant. He was rightly made specialist in his own subject, but in accordance with an excellent naval custom he was also expected to do some general duties and keep days on. Learning this, he "fell in" to see the Principal Medical Officer, to whom he explained that it was dangerous for him to keep a day on, as he might miss an "acute abdomen" or a case of infectious disease—because he was a "specialist." Much to his colleagues' disgust, he got away with it, and was relieved from days on. I may add that if I had been P.M.O. he would have kept day on and stop on, under his general practitioner colleagues, until he felt he could spot appendicitis or mumps with a degree of certainty required of the general practitioner. These little failings can be winked at ashore, where a much greater subdivision of labour is possible and desirable than at sea, but they need not be encouraged in the Services where, under the close conditions of living, they are less tolerable. In the Navy there is not the work for many whole-time specialists, because there are not enough special cases. Therefore we can avoid the narrowing effect of specialization while retaining much of its usefulness, by refusing to let medical officers specialize officially before attaining their "half-stripe" and sticking to the excellent custom of making specialist medical officers keep *au fait* with general medicine, and

with administrative duties. Another excellent naval custom, which I hope will never be dropped, is that all Surgeon Commanders should serve a commission at sea before further promotion. Among certain naval medical specialists and bureaucrats I know this custom is unpopular, but for the good of the Service and senior three-stripe officers themselves, I hope the rule will continue to be rigorously enforced, especially with regard to those officers who specialize in administration. Many hospital doctors and administrators, who have been long ashore, forget how rapidly the Navy has changed and is changing, and many also seem to forget, or perhaps never knew, that they are the servants of a sea-going Royal Navy. The specialist the Royal Navy wants is a man with at least the average knowledge of general medicine and surgery with an extra training in some speciality in addition thereto, but not in lieu thereof. Moreover, if the Service is to get the best results from its medical experts, they must be familiar at first hand with the conditions of life and duty in ocean-going submarines and triple sixteen-inch gun turrets, as well as in the "Victory" and the Ark.

It is probably an inexorable psychological law that early and whole-time specialization narrows the mental outlook, however plastic the original mind. It is logical to believe that an individual who is continually thinking of one small section of medicine, and only sees patients suffering from one type of illness, cannot help attributing a greater relative importance to his own subject than it is entitled to. Analytical psychology shows how a man's occupation, especially if it is a hobby as well as a livelihood, forms a mental complex which subconsciously influences his judgment and behaviour in completely irrelevant matters. A wise general practitioner is well aware of this, when he is loth to recommend a patient to consult Mr. So-and-So, because he fears that, whether his patient has housemaid's knee, or neurasthenia, he will return without tonsils, appendix or great intestine, according to the surgical complex which subconsciously sways all Mr. So-and-So's actions. The psycho-analyst himself, though he has done invaluable work in showing up the influence of the unconscious mind on the symptoms of patients and on the behaviour of the medical men who treat them, yet seems as prone to this defect as the ordinary man. What may be an example of this tendency in an eminent psychologist is Stoddart's [3] theory of sea-sickness. He says: "The sea is a well-known mother symbol which may be subconsciously associated with the respiratory rise and fall of the mother's breast while the infant is taking food. The rise and fall of a boat during a sea voyage tends to remind certain people of this forgotten situation in an unconscious way, and sea-sickness with its rejection of food is a mode of repressing this infantile memory." Candidly, as a naval surgeon and a dabbler in psychology who has given much thought to sea-sickness, I do not believe that Stoddart's hypothesis rests on a sure enough foundation of fact to recommend that only recruits who were bottle-fed as infants should be accepted for the Royal Navy. However, Trotter [4], a

brilliant psychologist as well as eminent surgeon, warns us that scepticism is not the hall-mark of a scientific mind. That it is just as often "an automatic mental defence against the painful irruption of new ideas." So perhaps I am trying to be funny at the expense of this analogy either because I am insufficiently educated in psychology or because some unconscious influence sways my judgment. Stoddart himself says that those unfamiliar with psycho-analytical investigations will reject this theory of sea-sickness. However, the illustration holds good even if the hypothesis is right, because I become the example of a mind refusing to believe the truth because some mental resistance prevents my making a logical judgment of the facts, subconsciously, using scepticism as a defence against the pain the acceptance of this novel theory would cause me.

Every specialism has its curative and progressive side. Nowadays the exponents of these two divisions tend to divide automatically into clinicians and laboratory workers. This is largely because most, but by no means all, recent progress in clinical medicine, has been secondary to laboratory experiments on animals and the training and time necessary to acquire the knowledge and technique of modern laboratory work has forced the majority of medical investigators to be whole-time professionals. As Fletcher [5] points out, the day of the amateur is practically over, and, perhaps as a result, the community, used to getting its medical research for nothing, grudges the research worker a fair share of worldly honours and a wage comparable to that of the practising clinician who freely markets the results of his laboratory colleagues' labours. Of course, when man is civilized scientific investigation will become one of the best paid professions, but meanwhile the researcher has to console himself with doing the job he likes best, a blessing given to few in this world. And, although the lack of cash is a real hardship, yet as regards worldly honours I expect most scientific workers agree with Huxley [6] that "The only order of nobility which becomes a philosopher is that rank which he holds in the estimation of his fellow-workers, who are the only competent judges in such matters."

The Services, contrary to the general view, offer one of the finest fields for any man with a craving for research, who yet is not sufficiently enthusiastic to slave for the best part of his life on £200 to £300 a year in a laboratory ashore. In the Service the would-be researcher will find leisure and opportunity for many types of investigation. In general the Service doctor should look on his research as a hobby and not expect a reward for it. He should remember that his Service duties as a practitioner of preventive and curative medicine always come first; he is neither asked nor paid to research. But in spite of this he will generally find plenty of encouragement from those in authority over him, both medical and executive, and even from his material, the ever-cheerful sailor—if he treats them the right way. Should he be lucky enough to produce results and get advancement thereby, he should regard this as a bonus on the advancement he has otherwise earned. It is noteworthy that in the Services

original work has been recognized and rewarded to an extent which I think is relatively greater than in the civilian profession—a point in which the organization of the fighting Services is ahead of civilian medical practice.

The man with a special bent for research will find plenty of scope for his activities, not only in well-equipped laboratories at the base hospitals ashore, but also in the spacious dispensaries of a modern ship of war, where a man good at devising makeshifts can, if he will, carry out academic laboratory and biological investigations at sea. But this is not the only work I include under research or progressive medicine. The Services offer an ideal field for medico-statistical investigations, for clinical, as opposed to laboratory, research, and for the study of epidemiological problems. Again, there is room for much research in "administration." Also there are still many interesting problems to solve as regards the food, clothing, work, and last, but not least, the psychology of the sailor. Thus progressive medical work in the Services is of a variety to suit anybody's fancy. Except when he is undertaking an investigation by order, the Service researcher is in an enviable position: he works to amuse himself only, he can choose his subject, do as much or little as he likes; it does not matter if, as often is the case, his work leads nowhere. He can publish or not, but if he thinks his results of Service interest, there are his own journals grateful for copy. In fact the Services are the happy hunting ground and one of the last strongholds of the amateur medical researcher. I use amateur in its literal sense as meaning one who does something for the love of doing it—not one who does something worse than a professional. I write this as an amateur hoping to encourage others to take up a most absorbing hobby. We amateurs spell research with a small *r*, we do not expect to make any discovery of general importance, we do not even mind if we discover things that have for years been general knowledge to those better informed. We are only amusing ourselves, but if something useful emerges from our pastime so much the better, but that is not the main object of amateurs. Although one may not wholly agree with the professor who at the end of a lifetime spent on some academic research said, "Thank God I have never done anything practical," yet, in these sordid times, one cannot but sympathize with his sentiment. There is, however, much investigational work which promises useful results to those who prefer to be practical. There are many problems of little outside general interest, the solution of which would be of value to the Service.

One could ask many conundrums of domestic interest to the Royal Navy, some of which should be answerable if anyone took the trouble to try to find out. There is plenty of progressive work which can be done at sea without any knowledge of out-of-the-way medical literature or special training in laboratory technique.

Now, although the majority of Service research workers are working for

their own amusement, if they publish serious results they should stick to the rules of the game, and make every endeavour to observe the highest standard of literal truth. I shall, therefore, discuss one or two common fallacies and tendencies which spoil much good work and should be avoided in scientific literature. There are two main methods of trying to find the causes of events: observational and experimental. There is really no hard line separating these methods. In the purely observational method, the human agent is passive. He waits for Nature to set the experiment, and records carefully what happens; when Nature has set enough experiments which appear to control each other, the observer makes his deductions. This is a very slow method of progress, as it may be centuries before Nature sets enough of the right experiments or the observer notices the salient points in them to give him the true interpretation he is seeking. In the experimental method the observer is active; he sets his own experiments, which are small imitations of Nature, and numerous control experiments; he alters condition and environment to suit his fancy and may find out in days things that would have taken centuries of passive observation, or could never have been discovered at all, without the observer's active interference. It is only within the last fifty or sixty years, with the advent of the bacteriological era, that experimental pathology has bulked so largely as a separate subject to applied medicine. The experimental method has only limited applications to human beings; but it has been found that the experimental method can be employed in studying disease in animals, and, in a way, it is surprising that the phenomena observed in experimental animals are as often as not found to hold good for man. Moreover, preliminary trials on animals and the experience gained in the technique of experimental science, are allowing a freer and more legitimate application of direct experiment on man himself. The application of the statistical methods, better record keeping, and Lister's gift to surgery, have also given the observational method a fresh lease of life. Before this renaissance of medicine, the observational method had about exhausted itself, and medicine was to a large extent a subject like religion.

The unquestioned acceptance of the pronouncements of authority and of the printed word, however desirable in religion or law, is incompatible with progress in science. No statement of any man, however great and learned, is to be taken as true just because that man made it. Here we may note the use and importance of references. In discussing scientifically any controversial point it is no use saying that Professor Highbrow said "this is so" unless you say why he said it, or give a reference to the original work from which he came to his conclusion, so that any sceptic can judge the evidence himself. Of course, we have to use and quote authority on any subject when we have not sufficient training or education to judge for ourselves. For example, if I want to make a statement which brings in a point in astronomy I am careful to consult and quote a well-known living

authority on the subject, such as, say, Professor Jeans, who, in the opinion of his colleagues, is up to date in all recent astronomical work, and whose conclusion on the point in question is accepted by the majority of astronomers, who are the only group capable of judging the evidence. Provided I have done this, I do not worry if any bacteriologist or surgeon, however eminent, any politician, or journalist, however popular, contradicts me on that point in astronomy, any more than I would worry if the greatest of astronomers criticized my views on the biology of the diphtheria bacillus. On the other hand, I am severely shaken, and review my position very carefully when Dr. J. A. Arkwright does so, because he is one of the greatest living authorities on bacterial variation. In your own subject, where you are capable of weighing the evidence for yourself, you may find what in your opinion is a reliable observation by a practically unknown investigator. Such work you are perfectly at liberty to use in support of your own theories, even if it is contrary to the pronouncements of the leaders of your own subgroup of the scientific herd. These few remarks indicate the proper use of authority in scientific work.

Now for a few words as to how it comes about that tradition and authority may hinder progress in knowledge. There has always been a strong instinct in any human herd to worship their dead leaders and respect old herd customs, and the medical profession is no exception. Far be it from me, a naval officer, to decry this tendency in everyday life. Without some such instincts no gregarious species of animal would survive. But because hero-worship is such a deeply ingrained mental character, its influence on scientific work must be carefully watched. We honour the scientific pioneers of the past none the less if we carefully re-examine their work and theories in the light of modern knowledge. And all traditions and herd customs, however admirable, require constant overhauling to ensure that they fit the ever-changing environment. Some present-day writers suggest that there has been little progress in clinical medicine which is not due to the older traditional methods, and that the experimentalists are getting a bit above themselves. Crookshank [7], for example, rebukes Harley Street for "The verbal quackery which allows us to pretend that we are nearer the ultimate understanding of life, death and disease than was Hippocrates." But I think such indictments are scarcely just, for the average modern investigator in ward, theatre, office, and laboratory, approaches his subject in a humbler spirit than the ancients, because he realizes more fully the complexity of biological mechanisms, and admits his complete ignorance of ultimate causes. Although it may savour of blasphemy to say so, what little I have read of the old masters of medicine does not lead me to believe that they were blessed with any greater intelligence than many who are alive to-day. Among those recently dead I would place Pasteur, Lister, Robert Koch, and Manson, on a higher plane of intelligence and attainment than Galen or Sydenham.

One might say that of recent years a large part of progressive clinical

medicine has been occupied with the attempt to re-edit our textbooks, and discover what statements are proved, what are probably true and founded on facts, and what are definitely false or mere pious opinions unbased on any accepted facts. As an instance of the unreliability of the older textbooks, I will give the extraordinary statement which used to appear in edition after edition of a popular book on surgery, namely, that a man with a urethral stricture had a corkscrew-shaped stream when he urinated. As a student, with an elementary knowledge of hydrostatics, I could not believe it, and at the next opportunity I watched two or three stricture patients urinate. Though the volume and initial velocity of the stream was less than normal, it descended in the parabolic curve and continued in the same vertical plane demanded by the first law of motion and the theory of gravitation. This absurdity illustrates a thing the scientific investigator must never let himself do. It might have been legitimate for the originator of the corkscrew hypothesis to have published his opinion as a speculation, and wait for the critic to slaughter him; but, seeing how easy this opinion was to confirm or refute by observing the next case of stricture, or experimenting with a piece of bent tubing, he would have been wiser to have kept his theory to himself till he could test it himself. Where he committed the "unforgivable sin" against science was to publish a hypothesis as a fact. Of course this is a very gross error, selected to illustrate a principle, but many statements in medical literature which are presented as if they were proven fact, have a low probability of being true. As the great investigator Sherlock Holmes said to that rather unintelligent practitioner, Dr. Watson: "It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories instead of theories to suit facts."

A class of work for which our standardized population, living under identical conditions of nutrition and environment and disciplinary control, forms admirable material, is the testing and comparing therapeutic or prophylactic agents. This form of work, unless carefully controlled, is especially liable to the great *post hoc ergo propter hoc* form of fallacy, which permeates and vitiates so much attempted research work in medicine that no excuse is necessary for bringing it up again. It is most interesting to note that we are all perfectly aware that a subsequent event is just as likely to be "in spite of" as "because of" a former event.

Trotter [4] has been so much impressed by the ubiquity of the *post hoc* fallacy that he thinks it the expression of a "characteristic cerebral function," a kind of conditioned reflex. If two events occur frequently enough in fairly close sequence, the mind automatically makes the first the cause of the second, without requiring a logical reason for doing so. There is no doubt that it is a specific criterion of man to be uncomfortable if he cannot supply a cause for any event. Therefore any "cause" becomes better than none. The history of primitive magic, religion and medicine proves this. The real cause not being self-evident, it is easy to substitute

a striking or exceptional recent event as a "cause," and thus ease the acute mental anguish of not knowing why, and hence the ubiquity of the *post hoc* fallacy. The absurd lengths to which the "*post hoc*" argument can be carried is best seen in the uneducated and mentally weak. I once asked a reservist his reason for objecting to vaccination. He answered that he was the only survivor out of three brothers, and the only one who bad not been vaccinated in infancy. I asked him what his brothers died from. He said that one had been killed in a street accident, and the other had died from pneumonia some fifteen years after the vaccination, which their brother firmly believed was in some way responsible for both their deaths. In therapeutics a host of alleged remedies have been recommended merely on the grounds that patients generally recovered after their administration. And, seeing that many such remedies may have been given as routine for generations and recommended by the highest herd authority, any inquirer who suggests that the patient may have recovered in spite of them is generally snubbed for questioning the experience of his betters. But if a man has always given castor oil to his appendix cases, what experience can he have of oilless appendicitis? Because the type and severity of a disease show marked deviations from the average at different times and places, there is practically only one reliable method of testing the value of therapeutic or prophylactic treatment which will eliminate the chances of falling into the *post hoc* trap. This is by taking all the admissions of the class to be treated as they turn up in hospital or sick bay, and treating alternately, one by the new and the next by the old procedure, until a sufficiently large number of observations has been collected to be of statistical significance. The severity of symptoms, the duration of illness, the mortality, and number of sequelæ in the two groups are then carefully compared. One may note that the smaller the variation in the behaviour of test and control group, the larger will be the number of patients that must be treated before any difference in the two series can be fairly attributed to anything more than luck. There is no better example of the successful application of this method than Leonard Rogers' working out of the treatment of cholera. For many years opium was the routine treatment of cholera, given, I believe, as much in the belief that it increased the patient's chance of recovery as that it made his passing more comfortable. First, by the above method of using alternate admissions as a control series, it was discovered that opium prejudiced a man's chance of recovery. The routine use of opium in the past must have killed thousands of cholera patients who would otherwise have recovered. Subsequently, by the use of the same principle Rogers perfected the hypertonic saline treatment of cholera.

Mackenzie [8] has said that "the principles of modern therapy are the same as those which have been in use from time immemorial—the giving of a remedy whose action we do not understand for a condition of whose nature we are ignorant." Like so many epigrams or aphorisms, this is true according to how literally we interpret it. The optimist would say

salvarsan cures syphilis, that we have a fair idea of how the remedy acts and of the nature of the disease. But the pessimist would be justified in replying we are not certain if syphilis is ultimately eradicated by salvarsan treatment, and that the scientific description of its action and of the pathogeny of syphilis is still far from complete. But even if the latter view is accepted salvarsan remains a valuable empiric remedy, because it has been proved according to the strictest of scientific standards that under its influence the early and observable lesions of syphilis will disappear more quickly than if left to themselves. It does not matter in practical medicine if treatment is empiric or "rational," provided there is a reasonable probability that any beneficial change in the patient, noticed after its exhibition, is due to the remedy and not in spite of it. The difficult question for the practitioner to decide is whether he should use the multitude of drugs or procedures which have been alleged to be remedies merely on the grounds that some patients got well after their use, but which have not been *proved* to do good, and may interfere with a patient's natural tendency to recover. The use of some traditional remedy which appears more or less innocuous is probably justified because of the beneficent effect any *placebo* may produce by suggestion. Nevertheless, it is certain that the application of drastic measures in the past, merely because they were the traditional practice, caused much unnecessary suffering and many deaths. But, with the patient and his friends clamouring for one to do something, and with the physician's natural desire to help, the attitude of masterly inactivity is hard to maintain. And I think, even to-day, the conscientious doctor is more prone to over- than under-treat his patients. I can illustrate this principle from the work of Alexander Bryson [9], a distinguished past Medical Director-General of the Navy, a man whose efforts deserve more recognition than they have obtained, a naval surgeon fifty years before his time, to whom the sea-going population owes not a little, if only for his work on the control of yellow fever in the Royal Navy. Bryson, in his book on African Fevers, severely criticizes the methods of treatment in vogue at the time, which consisted of copious bleeding, shaving and blistering the scalp, forced exercise, and, worst of all, mercury pushed to salivation; as much as 120 grains of calomel were given as a single dose. Bryson points out that, although if a man recovered from yellow fever he ought to have a rapid convalescence, yet the poor wretches who recovered often took months to regain their health, if they were lucky enough not to die from mercurial poisoning. He condemns all these measures as unscientific and would replace them with absolute rest, cinchona bark and tepid sponging, if indicated. Bryson concludes his indictment of the treatment in vogue in the Navy of his time with a striking paragraph, as true to-day as when written in 1847.

"In most men's minds an over-anxiety begets a disposition to do too much, while, in the absence of a proper reliance in the salutary effects of nature, they impatiently resort to change of measures, which can only tend to harass and disturb the patient."

Truly, after reading Bryson's account of the medical practice of his time, one can sympathize with Molière's jibe at the profession, when, in answer to Louis XIV's question, "What does your doctor do for you?" he replied: "Sire, we converse, he orders remedies, I do not take them, and I recover." I will introduce my last subject with the remarks of another French satirist, Voltaire, who said of a certain physician: "He is a jolly good fellow and knows as much as the rest, and when he sees my teeth are falling out and I am suffering from scurvy, he says I have a scorbutic affection." Words and phrases can often be different and yet mean the same thing, and *vice versa* they can be the same and mean something quite different. Progress in medicine is greatly hindered unless there is no ambiguity about what a writer means. Voltaire's sarcasm illustrates a common failing. Doctors frequently consider that they have made a clever diagnosis and patients are satisfied if a synonym for a symptom is used. The loose use of the terms rheumatism and neuritis to describe any sort of pains whose ætiology eludes us, is one of the best examples of this deplorable habit. In the Services we can stick out for a more honest standard of diagnosis on our official returns, on which we can surely afford to say: "I do not know." When I first joined the Service it was the custom that every patient must have a diagnosis, and the P.M.O. of my ward had all the tickets put out every Wednesday morning to see that the diagnosis was entered on each ticket. The Service category of P.U.O., though it has been a subject of much sarcasm, has everything to recommend it. It is honest and does not vitiate any conclusions a statistician may draw from sick records when it is strictly adhered to. In a recent paper which MacArthur read on indefinite fevers in the Tropics it was pointed out the unravelling of some of the many problems concerning this group was likely to remain impossible so long as many medical practitioners indiscriminately called fevers they could not place with reasonable certainty, enteric, influenza, dengue, malaria, sandfly fever or spirochætosis, according to the fancy of the moment. If progress is to be made in the prevention and treatment of such conditions, or of any condition, the diagnosis must approach certainty, and all doubtful syndromes must be honestly reported as undiagnosable, but carefully described in detail. We can at least be honest on official sick returns if we cannot be so to our patients. There is another way words and phrases lead to misunderstanding in medical literature. So many words have changed their meaning or are used by different classes of workers with different meanings. In a paper before this Section [10], I showed how different usages of the words "typhoid" and "enteric" had led to much confusion in medical literature. Another example of a word that causes endless difficulties and conveys a widely different concept in ward and laboratory is "virulence." When such doubtful expressions have to be used it is well for the writer to define as carefully as he can what he himself means by them. Huxley gives a good example of how the same word with the passage of time comes to mean two different things. The Latin word

"spiritus" means "breath," which the ancients considered the most refined part of man. Hence, when the alchemists first distilled alcohol from wine they called it spiritus because they considered their distillate the most refined part of wine. Therefore, says Huxley [6], "We use the same word for the soul of man and a glass of gin." The precise meanings of words and phrases are important because one of the most difficult things in the world is to convey in words the exact shade of meaning the author hopes will be read into them. One has only to teach a little, to write a little, or compare an abstract with an original paper, to realize how easy it is for a student or reader to get hold of a concept which the teacher or author had not the slightest intention of conveying. In attempting original work, if one has to refer to someone else's investigations the original paper must always be consulted. Although abstracts are useful in finding papers bearing on one's own subject, yet in at least a third of the occasions where I have read both abstract and original paper, the author conveyed to me a different shade of meaning from that which he appeared to have transferred to the abstractor. I have seen reviews of my own efforts in which what I thought the important point had been omitted or misinterpreted. This was more likely my fault than the reviewer's, but it serves to demonstrate the real difficulty which many men find in writing unambiguous English. In official paper work I have always found that the most arduous part of my duty was translating the rough draft of a report into the King's English.

The highest possible standard of accuracy in diagnosis combined with a candid confession of inability to label a condition when such a standard is unattainable, is essential if progress in medicine is to be advanced by statistical methods. The environment of the Services is eminently adapted as a field for medico-statistical research, but it is no use pretending a lot of our vital statistics are as accurate as they might be, chiefly because medical officers will not confess their ignorance. In another address the importance of at least an elementary acquaintance with statistical methods and normal psychology was emphasized, if only to avoid the common arithmetical errors which often vitiate otherwise good work, and in order to realize that the mind is an instrument more sensitive to prejudice and emotion than to logic or fact. The points I have tried to make in this rather disconnected discourse may be summarized in the form of a short catechism which the would-be seeker after truth should always put to himself when confronted with any statement to which he is not personally indifferent. Do I believe—or disbelieve—this thing either, because I want to do so, because it is the custom of my herd and my heroes to do so, because of a *post hoc* argument, or because I have misunderstood the author? In this way I think one may reduce to a great extent, though never altogether, the subconscious bias that sways all our thoughts and actions. Finally, these remarks were made only as regards Science, who demands of her servants that, irrespective of their own or anyone else's emotions, they eternally struggle to unveil her cold and dispassionate sister Truth. How

far it is advisable to carry this principle into everyday life I do not pretend to know. My own irrational reason tells me that suppose it were possible to step out of that phantasy which each of us knows is reality, we should be intolerably miserable, if not mentally dead. Life is only bearable because the mechanisms in our unconscious mind enable all of us, each in his own way, to be certain that black is white. This automatic action defends our consciousness from that merciless goddess Truth, and enables most of us to adapt ourselves fairly comfortably to any herd or environment into which we have been flung by that irresponsible jester Fate. Therefore as regards everyday life I would take the advice of that wonderful old psychologist King Solomon, who says : "*Be not righteous overmuch, neither make thyself overwise. Why shouldest thou destroy thyself?*" (Ecclesiastes vii, 16).

REFERENCES.

[1] Lewis, T. *Brit. Med. Journ.*, 1930, i, 479,
[2] Keith, Sir Arthur. *Lancet*, 1930, ii, 1053.
[3] Stoddart, W. H. B. *Ibid.*, 1924, i, 1081, 1239.
[4] Trotter, W. *Brit. Med. Journ.*, 1930, ii, 129.
[5] Fletcher, W. W. *Ibid.*, 1930, ii, 993.
[6] Huxley, T. H. "Critiques and Addresses," London, 1873, p. 30 ; *idem*, *ibid.*, p. 72.
[7] Crookshank, F. G. *Proc. Roy. Soc. Med.*, 1926, xix, 19.
[8] Mackenzie, J. *Lancet*, 1923, ii, 964.
[9] Bryson, A. "The Climates and Principal Diseases of the West African Station," London, 1847.
[10] Dudley, S. F. *Proc. Roy. Soc Med.*, 1928, xxi, 785; *idem*, *Public Health*, 1929, xlii, 219.

Editorial.

THERMAL ADJUSTMENT OF MAN TO EXTERNAL CONDITIONS.

THE thermal adjustment of the soldier during work in temperate and tropical climates has been a subject of great interest to Army Medical Officers for many years. Just before the war many experiments on the effects of physical exercise were made in the Royal Army Medical College under the direction of Colonel Melville, Dr. John Haldane and Professor M. Pembrey. It was then realized that there was an optimum temperature for the performance of work, usually about 1° to 2° F. above the normal. This rise in temperature is purely physiological and beneficial. Any increase of temperature beyond this however may be harmful, and as the performance of work necessitates the production of heat, man, being homoiothermic, is endowed with means of adjusting the thermal balance.

To keep a system at a constant temperature any increase in heat production must be balanced by a corresponding heat loss, and vice versa. This necessitates a very sensitive regulating mechanism set to a certain temperature.

Apart from voluntary modification of his surface by posture and of his insulation by clothing, heat loss in man depends on the temperature of his skin and the rate at which water is evaporated from it.

The proportion of heat lost by radiation, convection and evaporation is determined by the temperature of the surroundings, moisture in the air and wind. In 1896 Rubner found that a man at rest and comfortably clothed in a room having a temperature of 15° C., the air being 50 per cent saturated with moisture, lost 44 per cent of his total heat dissipation by radiation, 31 per cent by convection, and 20 per cent by evaporation from the lungs and skin. In 1928 Aldrich using modern methods arrived at the same conclusions.

When the atmospheric temperature approaches or exceeds that of the body, the loss of heat by radiation and convection becomes greatly diminished and the body may even receive heat. In these circumstances the only way in which thermal equilibrium can be maintained is by the evaporation of sweat.

A man at rest produces heat and if there is no loss by radiation and convection he must evaporate at least four ounces of water per hour, or his temperature will rise. If he does strenuous work the amount of fluid to be evaporated will be four or five times greater, or about one pint per hour, and if he works in the sun or when surrounding objects are hotter than the body the amount of water to be evaporated may be twice as much.

Hunt found that when doing survey work in India with an air temperature of 100° to 115° F., and walking in the sun at a rate of three miles per hour, the minimum consumption of water was three gallons per day.

These facts should be borne in mind when the water supply for troops operating in a tropical climate is being considered.

In the Croonian lectures delivered before the Royal College of Physicians in June last Sir Charles Martin discussed most of the work which has been done on thermal adjustments of men and animals and detailed his own experiments carried out during the past thirty years.

He described the mechanism of thermotaxis as consisting of afferent neurons with special terminations in the skin which are sensitive to temperature, and efferent neurons activating various mechanisms whereby heat-loss or heat production is varied, and a central co-ordinating machinery. The efferent nerves which modify heat-loss are the nerves to the vessels of the skin, to the sweat glands and to the erector muscles of the hairs. The nerve paths along which the impulses run which modify heat production are extensive and include the nerve supply to the musculature and all the active tissues of the body, including the endocrine glands.

Isenschmidt and his colleagues Krehl and Schnitzler as the result of their experiments arrived at the conclusion that the essential focus of nervous connections is situated at the sides and base of the third ventricle extending from the infundibulum anteriorly to just in front of the mammillary bodies posteriorly, with a lateral extent of about 3 mm. on each side of the third ventricle.

Martin outlines the experimental work which proves that the central mechanism of thermo regulation is itself sensitive to temperature and is so organized that it discharges impulses through appropriate nerve channels according as to whether its temperature rises above or falls below a predetermined level. He insists, however, that the mechanism, instead of waiting for its temperature to rise or fall, is in direct connection with the nerves of temperature sense from the skin and can bring about rapid adjustment reflexly by sending out efferent impulses which modify heat loss from the skin, or by sending out others which increase or diminish heat production.

According to Martin the conception of the central nervous mechanism for thermo regulation which best interprets physiological, pathological and pharmacological observations and experiments is a slight elaboration of the one put forth by Hans Meyer. Meyer considered the thermotactic apparatus to be composed of two coupled nerve centres, one is the thermogenic, the other the thermolytic centre. Each is sensitive to appropriate direct and reflex stimulation, their different connections being such that antagonistic results follow. Stimuli which activate the thermolytic centre at the same time inhibit the thermogenic centre, and vice versa. To the thermogenic centre Martin adds a third centre from which impulses occasion a sparing of heat-loss by constricting superficial vessels and erecting hairs ;

for the first and sometimes the only response to impulses along nerves from cold spots on the skin is to economize heat-loss in this way.

Regulating temperature by varying heat production appears to be the first method used by animals; as development proceeds physical regulation is employed. In 1895 Pembrey found that a chick within the egg behaved up to the eighteenth day like a poikilothermic animal, its production of carbon dioxide rose and fell with the temperature of its surroundings. Before leaving the shell, however, it had already acquired a considerable capacity to vary heat production according to the external temperature. The day after hatching the chick was found to double its carbon dioxide production when the external temperature fell twenty degrees. In 1896 Pembrey obtained similar results with mammals born in varying degrees of immaturity. He found they all possessed powers of regulating heat production varying with their state of maturity when they commenced their extra-uterine existence.

In 1902 Babak made observations on newborn infants and came to the conclusion that physical regulation is not present at birth, but is gradually developed a few days afterwards.

We have seen that temperature may be regulated by varying production of heat. Cellular oxidations outside the body have been studied by numerous observers. Separated from the body it appears that the cells of different organs use, weight for weight, much the same amount of oxygen. Under normal conditions the tissues use very different amounts of oxygen, the oxidation, according to Grafe, being controlled by the sympathetic system.

Barcroft and Brodie have determined the oxidation taking place in resting cells with their circulation intact. Resting muscle uses least oxygen and kidney most, weight for weight. The oxygen utilized by the whole body varies with age. The combustion rate at seven years of age is, weight for weight of body, twice that at 25 years and three times that at 70 years.

The partaking of food gives rise to a feeling of warmth. This is not due to the increased work of the alimentary canal, it is a specific effect of the food, and all three types of food are effective, but with proteins the increased combustion is greater and lasts longer.

One hundred years ago Voit studied the effect of external temperature on the rate of combustion of man and found that with a clothed man, in still air, the external temperature could be varied from 10° to 25° C. without increasing the amount of CO_2 which he produced, but when the rate of heat-loss was increased beyond this he began to burn more fuel and ultimately to shiver. Rubner obtained similar results and thought the increased combustion, before shivering occurred, took place in the muscles without movement and in other organs, especially the liver.

In 1890 Loewy and Johansson found in their experiments that there was no increased production of heat unless shivering occurred, and until

Hill and Flack made their experiments in 1914 physiologists believed that man relied upon physical regulation until the fall in temperature of his skin was sufficient to cause shivering. Hill and Flack studied the respiratory exchange of eight subjects at the London Hospital first in the laboratory, then in the open air with a breeze blowing which was not cold enough to cause shivering. They found there was an increased consumption of oxygen in the subjects in the open air.

Martin thinks the discrepancies between the results of the different observers can be explained by the way in which different individuals respond by chemical stimulation.

Hill and his colleagues found that not only was the respiratory exchange of patients increased in the open air, but the effect persisted for a fortnight after they were brought indoors. Gessler, from observations made on himself every day for a year, found that his oxygen consumption at rest varied inversely with the mean external temperature and was 10 per cent higher in January than in July.

From these experiments it is evident that the effect of cold is to raise the combustion rate. Warmth, however, has a reverse effect. Rubner and Wolpert showed that a warm skin had a depressing effect on metabolism and Plaut and Wilbrand, in 1922, found that if a man was made hyperthermic and allowed to cool down until his temperature was normal his basal metabolism was reduced 8 per cent. Recent experiments prove conclusively that the metabolism of Europeans living in the tropics is similarly reduced. In 1896 Eijkman, working in Java, came to the conclusion that the respiratory exchange of Europeans living in Java did not differ materially from that of persons of the same age, size and weight in Berlin. These observations were probably vitiated by the fact that the persons were not made to remain absolutely at rest for some time before the observations were made.

In 1929 Berkhout made very careful observations on twelve Europeans in Eijkman's old laboratory and the metabolism of these people was found to be reduced 10 per cent.

Hindmarsh examined 76 subjects in Sydney and found an average diminution of metabolism of 9 per cent in men and 10 per cent in women.

Martin reviewing these and other observers' experiments concludes that individuals react differently, some reduce their metabolism in the tropics, others do not. He made a series of experiments on himself during a voyage to Australia. He found in his own case that within a few days of encountering hot weather his metabolism, on awakening in the morning, began to fall and that the minimum was not reached until five days after he began to feel the heat. It was not a quick adjustment, but the reverse response on meeting the trade winds was quicker. The maximum difference between the oxygen consumption during the hot and cold periods amounted to 12 per cent.

When an adjustment persists after removal of the stimulus Martin

4

thinks it is an example of the indirect method of varying heat production through the greater or less activity of the adrenals and particularly the thyroid gland. Adrenalin has a very rapid thermogenic action, useful for rapid thermal adjustment, while that of thyroxin is slow and persistent. Plummer and Boothby found the maximum effect of thyroxin, when injected intravenously, occurred after ten days. The mode of action of these two hormones is not clear, but they are supposed to act as catalysts to cell oxidations. While there is little doubt that the varying activity of the adrenals and thyroid plays a considerable part in thermal adjustment, the experiments of Grafe and Redwitz on dogs and of Isenschmidt on cats, show that an animal some time after the removal of the thyroid is still capable of making a thermal adjustment by varying the production of heat. It starts at a lower base line, but failure to compensate is not apparent until the heat loss is considerable. Isenschmidt points out that the thyroid is not the only instrument at the disposal of the organism for thermal adjustment; it has a whole orchestra to play upon.

When the environmental temperature approaches or exceeds that of the body the only adjustment possible to rid the body of the heat formed is by the evaporation of water. The amount of heat lost by evaporation from the respiratory passages by a man working hard and breathing per minute one cubic foot of air half saturated with moisture at a temperature of 97° F. would be 0·25 large calories. This would be only a small contribution to the loss of heat required and the rest must be lost by evaporation from the surface of the body.

Water arrives at the surface of the skin by the imbibition of moisture by the epidermis from the moist cutis and by the active secretion of sweat. Martin found it was impossible to press water through skin from within outwards unless the epithelium was defective.

Only water molecules pass through the epithelial cells by transpiration, there is no accumulation of salts on the surface as after sweating. Hancock, Whitehouse and Haldane found that the amount of salt which could be washed from the body of a man unbathed for a week was trifling, though many litres of water must have passed by transpiration. Loewy and Wechselmann determined the amount of water transpired in twenty-four hours by two persons with congenital absence of sweat glands and taking their highest figure the loss would only be 0·18 calorie per minute. The chief loss of heat during work is by the evaporation of sweat. Sweating may be produced by local warmth or by central thermal stimulation and experimental evidence points to the latter being the more essential. The easiest way to make a man sweat is to increase the temperature of the blood supply to the brain.

Kittermaster showed that at the commencement of sweating, organic matter is in excess of salts in the sweat, but as sweating increases and becomes profuse the salts preponderate and the organic constituents diminish. From the point of view of work in a hot environment the

organic constituents are not of much importance, but the loss of salts may be material, as in ordinary circumstances they are replaced only by water. Martin has calculated that the loss of salts may amount to 10-20 g. per day. In 1929 Hancock, Whitehouse and Haldane showed that miner's cramp was due to "water poisoning" and might be obviated by drinking 0·2 per cent sodium chloride solution instead of water. So long ago as 1908 Elliott recorded that the best way of treating miner's cramp was with saline enemata.

Moss showed that miners working in an atmosphere with a wet-bulb temperature of 85° F. lost, on an average, two pints of water per hour by sweating.

It would be expected that this great loss of water by the skin would be accompanied by concentration of the blood. This does not appear to be the case as with the onset of sweating there is a flow of water, salts and proteins from the tissues into the blood which becomes richer in plasma and poorer in corpuscles. When the sweating is profuse and prolonged the fluid available from the muscles and tissues reaches the limit; sweating then diminishes, the blood concentrates and the individual is in danger of hyperthermia.

The effect of sunshine on the thermal profit and loss account has been studied by Martin. It is common knowledge that sunshine with a low air temperature is comforting, but with a high external temperature it is oppressive, especially when work has to be done.

The amount of energy in heat units a man may absorb when exposed to the sun depends on the amount of surface illuminated. Martin found, in his own case, that with an area equivalent to 4,450 square centimetres at right angles to the sunlight the total energy impinging will equal 3,420 calories per minute, which is three times his resting metabolism and equal to the extra amount of heat he produced when walking three and a half miles on the flat.

In a temperate climate the amount of work which a man can do depends on his muscular development, skill, and circulatory and respiratory capacity. In a hot climate these factors operate, but the limit of work accomplished also depends on the rate at which he can get rid of the heat produced.

In 1913-1914 Martin made experiments to determine the climate limitation in his own case and decided to keep the rate of work at $\frac{1}{10}$ horse-power, or 3,300 foot pounds, which was considered the output of a good labourer doing hard manual work. He found his rectal temperature rose at the commencement of work and remained at varying levels according to the severity of the conditions, and especially the temperature of the wet bulb. He sweated profusely and lost 1-2 pounds in weight per hour. The maximun wet-bulb temperature that he could endure was 87° F. and it did not seem to make any difference whether the simultaneous dry-bulb was 86° F. or 101° F. These experiments confirmed Haldane's observations that

when heat regulation depends on sweating the dry-bulb temperature is immaterial.

A rise of 1° to 3° F. is so universal when doing work that Zuntz and Schumburg and Pembrey regard it as physiological. Every physiological process works better at a temperature above the normal, and oxygen is then more easily dissociated from hæmoglobin.

Work in a hot climate demands a strong heart and that is why young vigorous persons do best in such a climate, and why breakdown of thermotaxis is more likely to occur when weary at the end of the working day.

According to Martin the great obstacle to work for a European in a hot climate is clothing. "The coolie works with his nice brown body exposed and covered with sweat and is jolly, whereas the white man distressfully labours in a hyperthermic condition, straining his heart to work a refrigerating plant which he has rendered inefficient because his sense of dignity forbids him to expose his skin."

Clinical and other Notes.

REPORT OF A CASE OF CLAIRMONT'S OPERATION FOR RECURRENT DISLOCATION OF THE SHOULDER.

By Captain F. M. COLLINS,
Royal Army Medical Corps.

The surgical treatment of recurrent dislocation of the shoulder-joint cannot be said to be standardized, in the sense that there is any one operative procedure universally practised by surgeons for the cure of the condition. The oldest operation of arthrodesis, aiming at bony ankylosis of the joint, is not practised now and can seldom be justifiable. Ingenious operations have been devised and carried out by French surgeons to lengthen the coracoid process, and thus create a bony barrier to resist the tendency to dislocation; apparently a good deal of success has been obtained by those conversant with the technique.

Clairmont's operation has the advantage of aiming at a cure of the condition on physiological principles. The stability of this joint depends almost entirely on the support derived from the large muscles in intimate relationship with it, and the operation is designed to procure an extra muscular support across the lowest part of the joint, admittedly the weakest, where muscular tissue is lacking. It is supposed that the transplanted slip of the deltoid muscle, with its vascular and nervous supply intact, acts in conjunction and simultaneously with the main muscular mass, so that when the latter contracts and abducts the arm, the transplanted portion contracts too, below the surgical neck of the humerus, and keeps the head of the bone in the glenoid.

The teres minor muscle, supplied as it is through a ganglionic enlargement, from the circumflex nerve, normally acts in this manner in conjunction with the deltoid, and tends to hold the humeral head in the glenoid during abduction; possibly some abnormality in the development of this little muscle or in its nerve supply may predispose to recurrent dislocation. The deltoid slip is designed to produce, as it were, an accessory teres minor, similar in action and nerve supply, but different in attachments. It is a little doubtful whether this ideal is in fact attained, but at all events, even if the muscle does degenerate into fibrous tissue, an additional fibrous support acting as an inferior ligament is obtained.

Cases of recurrent dislocation of the shoulder are of sufficient rarity, and opportunities of carrying out this operation sufficiently few to make it worth while recording the present case. The patient was an Indian cavalry

soldier, aged 27. He had had four dislocations of the left shoulder-joint during the past four years ; the last two were the result of a very mild degree of trauma. All were apparently subclavicular in type, and all were successfully reduced. When first seen, the shoulder-joint was normal in every way, with a full range of movement, and X-ray excluded any complicating bony lesion. The patient's mental attitude was somewhat upset by his repeated accidents ; he was afraid to use the arm for any heavy work, and was anxious for an operation. This was carried out on December 3, 1929. The patient was placed on his back with a sand-bag beneath the left scapula, the arm slightly abducted at the shoulder. The anterior incision followed the anterior border of the deltoid for 5 inches, starting 1 inch below the clavicle. The anterior border of the deltoid was cleared, and by retracting this muscle outwards, the subscapularis muscle was reached. Finger and gauze dissection in the axillary fat, defined the interval between the subscapularis and teres major muscles, and separation of their adjacent edges exposed the quadrilateral space from the front. It was not necessary to divide the pectoralis major tendon, and no vessels of any size were encountered. The wound was now packed with gauze and the arm drawn forwards over the chest to expose the scapular region for the posterior incision. This was made one inch in front of and parallel to the posterior border of the deltoid, from the deltoid tuberosity upwards to within one inch of the spine of the scapula. This long incision proved, as a matter of fact, unnecessarily long ; it is essential in this operation to go well down the arm, on to the deltoid tuberosity in order to get as great a length of muscle as possible for the deltoid flap, but there is no need to extend the incision higher than the junction of the upper and middle thirds of the deltoid. The deltoid muscle was next cleared and its posterior border defined by undercutting the skin backwards towards the middle line, and raised from its deep relations by finger and gauze dissection. The vertically running fibres of the long head of the triceps were thus exposed and retracted backwards (i.e., away from the arm), and the quadrilateral space exposed from behind ; the posterior circumflex vessels, especially the vein which was a large vessel the size of a lead pencil, formed a prominent landmark at this stage, and as they emerged to the back of the arm showed the position of the contiguous margins of the teres minor and teres major muscles. The deltoid flap was next cut ; it was made one inch broad at its upper end, where it was freed from the main mass of the muscle within 1½ inches of the spine of the scapula, and tapered to the point below, where the tendon was separated from the bone with a raspatory ; a few small nerves ran into the flap and were avoided, and a good many muscular vessels required ligature.

It was now possible by further finger dissection with a hand in each wound to open up completely the quadrilateral space from back to front. A pair of tissue forceps were passed from the anterior to the posterior wound through the quadrilateral space and made to grip the end of the flap.

Traction on the forceps drew the flap forwards through the quadrilateral space into the anterior wound.

The posterior wound was closed with a few deep catgut sutures and a continuous skin suture of silkworm gut. The anterior wound was reopened, and the apex of the flap sutured to the anterior border of the deltoid as high up as possible with a couple of mattress sutures of catgut; the anterior wound was similarly sutured with a continuous silkworm gut stitch. The arm was bandaged to the side with a pad of wool in the axilla. The progress of the case was uneventful from the first; the elbow was moved after a week and abduction of the arm started after two weeks, massage being begun at the same time. The extensive wounds healed by first intention. For some time there was a depression at the back of the shoulder corresponding to the place where the flap had been cut, and there was anæsthesia of the shoulder region in front of the posterior incision, from the section of the cutaneous branches of the circumflex nerve. The patient left hospital after six weeks with a normal range of movement at the shoulder-joint.

Unfortunately, while on leave in his village after leaving hospital, he contracted pneumonia, and a good deal of muscular wasting and stiffness of the shoulder resulted from his enforced confinement to bed during his illness. He was readmitted for this, and a fortnight's massage with active and passive movement got rid of the stiffness entirely.

When last seen, three and a half months after operation, there was again a full range of movement, and the patient was anxious to get back to duty. The depression along the posterior border of the deltoid was still noticeable, but the anæsthesia had cleared up.

The operation presented no technical difficulties; in fact it was easy to define and identify the various anatomical structures met with. The shoulder-joint itself and the large vessels and nerves of the axilla were neither seen, nor looked for. The operation was a nice anatomical exercise, and illustrated the difference, and to my mind the greater simplicity of the anatomy of the living body as compared with the cadaver. Some authorities recommend that the flap should be sutured anteriorly to the coracoid process; in the present operation this would not have been possible, as the flap could not have been cut long enough. Exposure of the coracoid would have necessitated division of the pectoralis major tendon, an unnecessary step in the present case. Suture to the deltoid in front seems quite adequate.

My thanks are due to Lieutenant-Colonel W. E. Brierley, F.R.C.S., I.M.S., at whose request I first saw the patient; to Lieutenant-Colonel S. Whitworth Jones, O.B.E., I.M.S., O.C., I.M.H., Lahore Cantt, in whose hospital the operation took place; and to Captain W. J. A. Coldstream, I.M.S., for his able help during the operation and for his painstaking attention to the after-treatment.

PERCAINE AS SPINAL ANÆSTHETIC.

By Major G. G. COLLET,
Royal Army Medical Corps.

The particulars of a case of spinal anæsthesia in which the anæsthetic used was percaine may be of interest. This drug seems to be a great advance on stovaine. The case for operation was a recurrent inguinal hernia, and the civilian surgical specialist, Dr. E. V. Lockett, asked my permission to use the new method of anæsthesia. Dr. Gray, the Government Pathologist of Jamaica, gave the injection.

No special preparation was given to the patient; 12 cubic centimetres of 1 in 1,500 percaine in 0·5 per cent NaCl solution of 1003 specific gravity was used and injected between the second and third lumbar vertebræ.

The patient's blood-pressure was taken before the operation and found to be 68/130 mm. Hg. After the lumbar puncture an injection of 1½ grains of ephedrine was given subcutaneously; this was given to keep the blood-pressure up; the blood-pressure rose to 74/142 after the operation, i.e., after three quarters of an hour.

After the lumbar puncture the patient lay on his face five minutes, and then was turned on his back and placed in the Trendelenburg position of 10° to 15°; this is necessary because the specific gravity of percaine is lower than that of the cerebrospinal fluid, and this position prevents the anæsthetic rising to a dangerous high level. In the case of stovaine, whose specific gravity is higher than that of the cerebrospinal fluid, the patient's head and shoulders have to be raised.

In about ten minutes complete anæsthesia and relaxation were obtained up to the nipple line. The patient felt perfectly well during the operation and the relaxation of muscles was complete. Muscular power and sensation were gradually regained two to three hours after the operation.

The patient complained of pain in the upper abdomen six hours after the operation; I attribute this pain to the anæsthetic. as it was analogous to the severe pain so often experienced after the use of stovaine. The pain disappeared immediately after the injection of ¼ grain of morphia and apart from this he had no untoward symptoms of any kind.

I should like to hear of more cases of this form of anæsthesia, as if successful it seems to have great possibilities, especially in the tropics.

Echoes of the Past.

THE FIRST AFGHAN WAR, 1839-1842.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

In 1838 Lord Auckland, the Governor General of India, alarmed at the supposed Russian sympathies of Dost Mahomed, decided to invade Afghanistan and restore Shah Shujah, the evicted Amir, who was an exile in British India, a procedure which involved no uncommon risk, as, at that time, our most advanced depot was at Karnal, and the frontier line ran through Ferozepore, Ludhiana and Bhatinda. Between this and the Afghan passes lay an area of four to five hundred miles controlled by Ranjit Singh the ruler of the Punjab and the Amirs of Scinde, both very uncertain allies.

Following an agreement with the former a column of the Bengal army 10,000 strong was mobilized at Ferozepore on December 10, and marched by the line of the Sutlej and the Indus to Sukkur, which was reached in January, 1839. The sick and medical stores were carried in boats, which were later used to bridge the Indus. This column was followed by another of 5,000 troops of the Bombay army, which was landed at the mouth of the river, and 6,000 Indian auxiliaries under Shah Shuja. These were united at Quetta[1] under Sir John Keane towards the end of March, forming a force of 15,000 troops and 79,000 followers. At the same time a small independent force of irregulars and Sikh allies, under the orders of a political officer, concentrated round Peshawar in the Sikh country.

The regimental medical establishment of the European regiments in India then, and for many years later, was very complete and self contained. Each battalion had a surgeon and two assistant surgeons, all three qualified and commissioned medical officers, a steward, an apothecary[2] and a full menial staff, bringing the total to forty-eight. Hospital beds were provided at the rate of 12 per cent, and the 10 per cent of doolies allowed when on the march involved the employment of some 200 kahars.[3] The medical stores and camp equipment took sixty camels for their transport. The Indian battalions had each one European medical officer of the Hon. East India Company's service, usually an assistant surgeon. The general

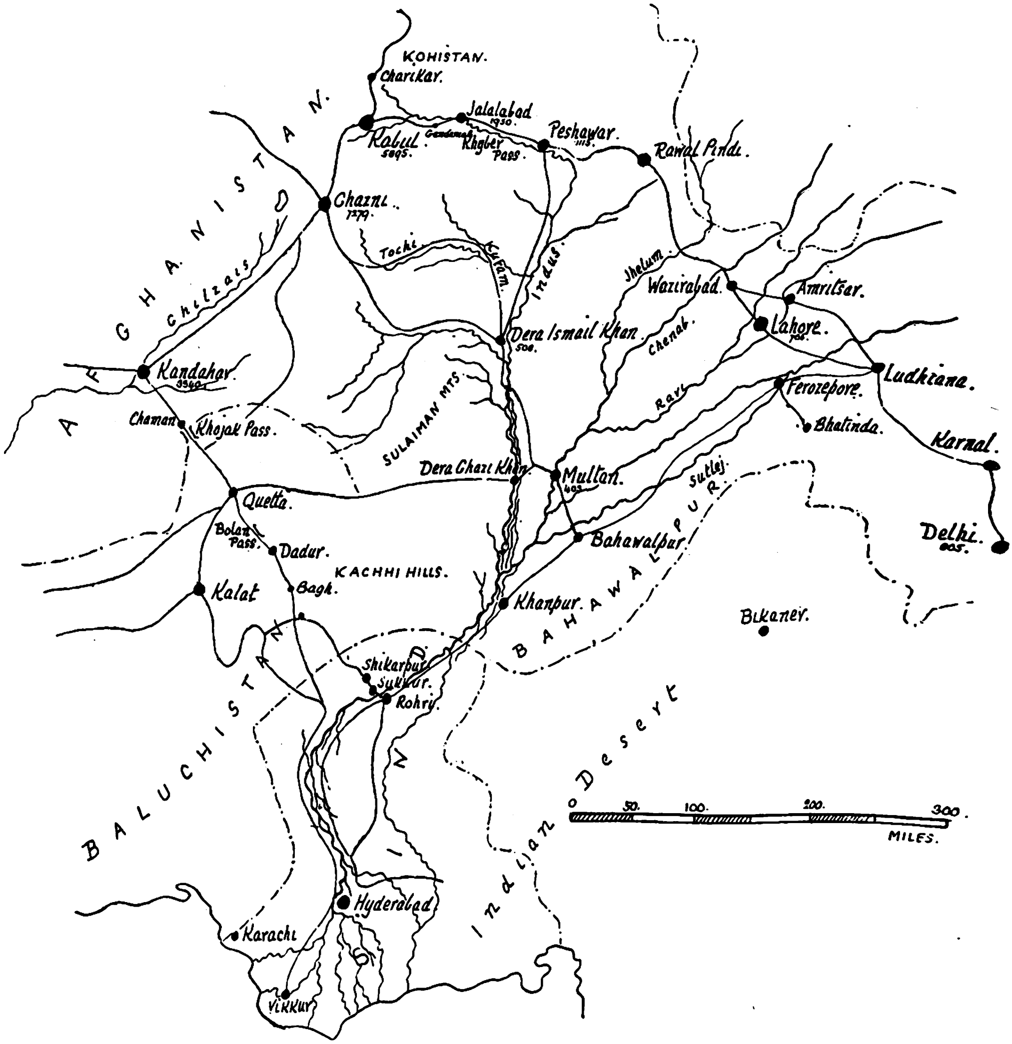
---

[1] Quetta was described as "a miserable mud town with a small castle on a mound, on which was a small gun mounted on a ricketty carriage."

[2] The Apothecary seems to have corresponded to the present-day Assistant Surgeon.

[3] This number had on occasion to be much increased. The 101st marched out of the old Anarkali cantonment at Lahore in the autumn of 1850 with 3,000 bearers.

medical staff officers, comprising a superintending surgeon, field surgeon and storekeeper, were almost invariably found from the Company's establishment. Wellesley had insisted during the Assaye campaign, thirty-five years before, that a reserve of junior officers should be supplied to staff



any field general hospitals it might be necessary to form. If any were provided in the army of the Indus, their numbers were entirely inadequate. He had also ordained, in spite of resistance on the part of regimental commanders and their medical officers, that, on active service, sick unfit to march must be dropped, with proper precautions for their protection, in sick depots. But at this period it was customary in India, except when

dire necessity compelled, to carry forward the sick and wounded even in the face of the enemy rather than separate them from their regiments.

Doolie bearers were found by the Commissariat. Since Wellesley's time, their allotment in the field was entrusted to the superintending surgeon, who kept a proportion under his own control. He also carried enough medical stores to provide for a field general hospital, but it seems very doubtful if he had any personnel to staff it, menial or otherwise, without drawing on the regimental establishments.

Little military resistance was offered to the march of the columns through Scinde and up the Bolan Pass, though there was some trouble from Baluchis who hung around the line of march and cut up stragglers. There was the utmost difficulty in collecting supplies. The Bengal column was reduced to half and quarter rations and the situation of the whole force when concentrated at Quetta was still most precarious. Vast quantities of baggage were carried, much of which, owing to casualties among the transport animals had to be abandoned. There was a sick wastage of 20,000 camels.

The march of the Bombay column, two infantry brigades, a cavalry brigade, two troops of horse and two of foot artillery, has been described by Richard Kennedy the superintending surgeon. The hospital stores would have sufficed for a force four times the size. He had eight camels for his personal baggage; one of the brigadiers had sixty. Slipper baths of copper and block tin were among the loads. At Quetta he found one of the officers looking for a sideboard. His staff consisted of Dr. Pinkey the field surgeon and Dr. Don the deputy medical storekeeper. The transport of the sick as far as Sukkur was provided for by four flat-bottomed boats which held forty patients each, the field surgeon and two assistant surgeons being in charge. Doolie bearers accompanied the troops on the march. At Julalkote there were twelve cases of cholera and eight deaths, but the first part of the march seems to have been a healthy one. The men carried a weight of nearly sixty pounds. At Tatta, a small cantonment was marked out. The P.M.O. protested against the site, but was snubbed. He noted that the hospital records of the 26th Native Infantry, who remained in garrison there, subsequently showed 1,526 admissions and ninety deaths in six months. This was probably from malaria. At Sukkur, where the river transport had to be dispensed with, Dr. Don was left behind with the surplus medical stores. Here he opened what was called a depot hospital. In traversing the Bolan Pass the heat was severely felt and there was some increase in sickness. The thousands of dead camels which marked the track of the Bengal column are said to have poisoned the water, and no doubt the foul state of the narrow and restricted camping grounds contributed. The sick were carried in doolies, but in the Bengal column the superintending surgeon, James Atkinson,[1] urged the adoption of camel

[1] Dr. James Atkinson was a Persian scholar of much repute. He was for many years assistant assay master of the Calcutta mint and director of the Government gazette.

kajawahs as used by the inhabitants of the country. The appliance was described as a wooden frame about 4½ feet long by 3½ broad with a seat for two men, the sides being filled with gunny cloth. Each camel carried a pair and therefore four patients. Pads to obviate sore backs were found to be necessary and, as in our last Waziristan campaign, their careful fitting was found to be of supreme importance. In June ten pairs were authorized for British and five for Indian regiments, and proved a success.

The united columns left Quetta on April 7, and proceeding by way of the Khojak Pass, reached Kandahar on the 25th. Over a month was spent in attempts to collect transport. The men suffered greatly from the heat in their single fly tents, and several cases of fever, dysentery and jaundice occurred among the Bengal troops. On the lines of communication casualties from heatstroke reached alarming proportions. At Shikarpur, where in April the temperature rose to 120° in the tents, two officers were found dead on their beds "their bodies turning as black as charcoal." In May a wing of a native infantry regiment escorting a convoy from thence to Quetta, lost 6 officers, 100 sepoys and 300 followers from the same cause.

When the Commander-in-Chief moved out of Kandahar on June 27, the troops were on half, and the followers on quarter rations. The ration of the latter seems to have been a nominal one; many subsisted on dried sheep skins and congealed blood, the refuse of the slaughter house. There was a failure of the spirit ration which was considered by many to be a blessing in disguise.[1] Capt. Havelock noticed increased bodily power and resistance to disease as well as improved discipline. Dr. Atkinson attributed the remarkable way in which deep sword cuts were found to heal to the absence of the spirit ration.

On July 21 the whole force was camped outside Ghazni, which, contrary to expectation, was found to be strongly held. There were only three days' rations in hand and the siege train was far in rear; there was therefore no alternative but to attempt an assault. This was fixed for the night of the 22nd-23rd the objective being the Kabul or north gate which, having been blown in by the engineers, was to be carried by parties of the Queens, 17th Foot, 13th Light Infantry and 1st Bengal Europeans.

The spirit of the troops was excellent. On visiting the regimental hospitals of the Queens and 17th Dr. Kennedy found that every man who could stand on his legs had joined the ranks while the rest had put on their uniforms and taken the place of the hospital guard. Each division had its main dressing station. Kennedy was assisted by his field surgeon Dr. Pinkey, Smith and Hunter, the surgeons of the two British Infantry regiments, and Chatterton of the Poona Horse. Assistant surgeons Thatcher and Cannon were with the assaulting troops; Watkins, Ranchard

---

[1] The rum ration was two "drams" a day– apparently 8 ounces—and normally an unlimited amount of arrack could be got in the regimental bazaar.

of the artillery, and Grant of the engineers formed an aid post by the guns, which were massed about 300 yards from the point of attack. The field hospital tents of the Bengal division were pitched about a mile S.E. of the fortress. Here Dr. Atkinson and his staff awaited the outcome of the event. At 4.15 a.m. there was a tremendous crash. "In half an hour more as the darkness was wearing away," he writes, "we perceived a dhooly coming up to us, the bearers hurrying with the greatest speed. It contained a soldier of the European Regiment, and to our inquiry 'What news?' 'We have done 'em' was the ready and gratifying reply."[1] As soon as the storming party were fairly inside the fortress, resistance collapsed. Our casualties were 17 killed and 165, including 18 officers, wounded, many of these being from sword cuts.

After the battle, Sir John Keane proposed to leave the sick and wounded in a general hospital in the town, but the superintending surgeons, who had already dropped portions of their field equipment at Sukkur, Quetta and Kandahar, found themselves unable to provide for such a contingency, so Dr. Pinkey and three regimental assistant surgeons were left with the worst cases, the rest, apparently about 250, being carried on in doolies. Fortunately little further resistance was offered, and Kabul was occupied on August 7.

A division of all arms was distributed between Kabul, Ghazni, Kandahar, and Jalalabad—the last having been occupied by a force of irregulars and Sikh auxiliaries under Lieutenant-Colonel Wade operating from Peshawar—the remainder, including most of the Bombay army, returned to India or took over the lines of communication through Scinde. Dr. Atkinson remained at Kabul as P.M.O., but was later relieved by Dr. William Duff. Dr. Kennedy accompanied his division as far as Sukkur where he left the force on promotion to a seat on the Medical Board. He received an appreciative reference in column orders, and published a departmental order of his own congratulating his officers on having won the approbation of higher authority and on the way their duties, professional and financial, had been performed. He was evidently a genial and popular person. He had strong views on the contagious nature of cholera, which he expounded in a pamphlet. Like others of his contemporaries, he yielded to the temptation to write occasional verse. Both he and Atkinson wrote descriptions of the campaign.

A part of the returning troops under General Willshire was diverted to deal with Khelat, which was assaulted by the Queen's and 17th Foot on November 13. On resuming the march, some of the column, including the 4th Light Dragoons (Hussars) and the Horse Artillery, passed through Bagh. The author of "Dry leaves from young Egypt" describes their arrival at Shikarpur on the 25th. "There was little of the elation of men returning from a successful campaign. Death in fact was busy in their

[1] James Atkinson. "The Expedition into Afghanistan."

ranks. That dreadful scourge, the cholera,[1] had made its appearance among them at Bagh. Dr. Forbes of the 1st Cavalry was the first victim, an officer much esteemed. From that moment the malady spread with frightful rapidity. In four marches they reached Janiderah. It was then no longer possible to bury those who died. The jungle and the roads were strewn with corpses. . . . I rode a little way into the town and about the camp. Many Europeans were lying on the ground intoxicated. In front of the Agency they were digging a large pit, another outside the wall. They had thrown thirteen of the dragoons into one, and at least as many of the artillery into the other. At least a hundred died that night."

The British troops engaged in the operations of 1839 had a sick mortality of about 10 per cent. The hospital admissions were roughly 2 per head, and the prevailing diseases mentioned were fevers and dysentery. The death-rate among the native troops of the Bengal division was about one third of this. The units which suffered most were the 31st and 47th Native Infantry, who marched from Shikarpur by detachments in May, June, and July, and arrived at Quetta with inadequate clothing and bedding, when they went down with malarial relapses. There seems no reliable record of the health of the native troops of the Bombay division, but, from Dr. Atkinson's statements, it must have been at least double that of his own division. That officer did not think much of the medical arrangements of the rival army, and claimed a case mortality of 3·75 per cent for Europeans as compared with Dr. Kennedy's 6 per cent. Discipline throughout on the lines of communication was lax, there was little or no attempt at co-ordination, the needs of the troops and sanitation generally were badly attended to, and, as a result, sickness originated in the various staging posts. Quetta had a bad reputation. When the winter set in, no provision had been made for palliasse straw, for hutting the men, or even for fuel. In Scinde up to the end of 1842 the British soldiers were crowded in low mud huts without doors or windows with the thermometer standing at anything up to 120° F. It is not surprising that far too much arrack was consumed. The amount of drunkenness was no doubt deplorable, no doubt also it was the cause of much ill-health, though by no means all it got the credit for. Considering the life they had to lead, and the food they had to eat, the deprivation of the daily rum ration would have inflicted a real hardship on the majority of the men, moveover the doctors recommended it as a protective against cholera. That alternative amenities might be provided to brighten garrison duty in the tropics was still only dimly realized. The regimental officers did their best, according to their lights,

[1] The British army made its first acquaintance with cholera during the Pindari War of 1817, and at intervals during the next 70 years suffered from these devastating visitations which science was powerless to control. On the ship which brought Sir Charles Napier to Scinde in September, 1842, sixty-four out of 200 British solders died between Bombay and Karachi. The 86th (2nd R. Ulster Rifles) at Karachi in June, 1846 had 410 admissions and 238 deaths excluding several women and children.

and with their slender means, but there is no evidence at this date that they received either help or encouragement from above.

When the Bombay division left Afghanistan the field hospital was broken up, and most of the doolie bearers returned to India to be discharged. The Kabul garrison settled down in cantonments outside the city, some of the officers were joined by their families, others set up establishments of a different kind within the walls. Unfortunately Sir John Macnaghton, the envoy, totally underestimated the patriotic spirit of the Afghan people, who, if they agreed in nothing else, united in resenting our occupation, and had no opinion of Shah Shujah, whom we had placed on the throne. Our forces were scattered in small garrisons, and harassed continually by Macnaghton and his subordinates, who ordered them about on impossible military excursions designed and directed by themselves. Relations between the politicals and the military were strained, and at the same time discipline and moral deteriorated.

In November, 1840, the deposed amir, Dost Mahomed, surrendered, after routing a small detachment sent against him in the Parwandara valley. Among the British officers killed in the encounter was Dr. Percival Barton Lord of the H.E.I.C.'s medical service, a most talented political agent on the envoy's staff, who had charge of the operations.[1] Throughout the following year the storm gathered. The treacherous attitude of the Sikhs threatened the communications with India. Nearer Kabul, the Ghilzais rose, were suppressed, and rose again. On November 2, 1841, Sir Alexander Burnes, the agent in Kabul, was murdered in his house. During the summer a brigade under Brigadier Shelton, including H.M. 44th (Essex Regiment), had arrived, and, at the time, another brigade under Brigadier Robert Sale, containing the 13th (Somerset L.I.), was fighting its way back through the passes and had reached Gandamak. Attempts were made to recall it, but without success. On the 14th the Kohistanis in the north fell on the Gurkha garrison of Charikar. Water failed, all but two officers had fallen, and the remainder decided to try and break through to Kabul. As they were preparing to break out, Haughton, the adjutant, was attacked by a treacherous native officer, the gate was rushed, and general confusion ensued. In the midst of the chaos Dr. Grant, the medical officer, amputated the wounded officer's hand, and, having spiked the guns, took command of the main body of the Gurkhas, while the remaining officer led the rear guard. Eldred Pottinger the political officer and the adjutant, both wounded men, went in front, and alone reached Kabul. Dr. Grant

[1] Lord, at the time of his death, was an assistant surgeon of six years' standing. He had served with irregulars under Captain Wade in the Khyber in July 1839, when he acted as A.D.C., and received the thanks of the Indian Government. These young politicals, many of them subalterns, were given a very free hand in dictating military policy, to the not unnatural indignation of the military commanders. Lord's handling of troops certainly gave grounds for criticism. He was killed in a cavalry charge. After the disaster of 1841 the relationship between the general in the field and the political officer was properly defined.

and Ensign Rose kept a part of the garrison together till within twenty miles of the town when the detachment was destroyed.

By this time the insurrection had become general. Lieutenant-General Elphinstone, who was in military command, though a gallant soldier, was 75, an invalid, and had lost all power of initiative. The situation was allowed to go from bad to worse, and the garrison at Kabul was besieged in their cantonments. On December 23, Macnaghton, while engaged in negotiations for a capitulation, was murdered. It was finally agreed that the army with six guns should be allowed to march unmolested to the frontier on the understanding that the whole country should be evacuated, a heavy indemnity paid, and hostages surrendered. The first demand accepted was that all married men and their wives should provide the hostages, but the General protested to the political officer that he had no power to control the movements of the women. He was then persuaded to offer pay at the rate of Rs. 2,000 a month to those whose wives would stay with them. This was refused practically unanimously, and the demand was not apparently pressed by the Afghan sirdars. Six junior officers were handed over. On January 6 the sick were sent into Kabul. The medical officers were ordered to draw lots as to who should remain behind. The duty fell on Assistant Surgeons Campbell of the 54th N.I. and W. Primrose of H.M.'s 44th. The last, unfortunately for himself, exchanged with Dr. G. K. Berwick the embassy surgeon. The march commenced on January 7.

The units which marched out consisted of the 44th (1st Bn. Essex Regt.), 1 troop Bengal H.A., 5th Bengal Light Cavalry, 5th, 37th, and 54th N.I., detachment Sappers and Miners, the Envoy's bodyguard, 2 rissalas Irregular Cavalry, and some units of Shah Shujah's contingent. The whole numbered 4,500 troops and 1,500 followers with several women and children. Of the fighting men, 690 were Europeans. The 44th had their surgeon, John Harcourt and their two assistant surgeons William Primrose and William Balfour. The medical officers of the Company's service were the superintending surgeon, William Duff, Magrath, in charge of the Artillery, Cardew, Metcalf, Harpur, Bryce and W. Brydon, the last being medical officer of the Shah's contingent. Everywhere, except in the ranks of the 44th and of the Artillery, there was confusion from the first. The sepoys, already sufficiently demoralized, were numbed with with cold,[1] and their line of march was disordered by the crowd of followers who broke their formation. The Ghilzais, who hung on the skirts of the column, looted the baggage and cut the throats of those that lagged behind. The same night Shah Shujah's contingent deserted. Ten miles were covered in the first two days, the snow was on the ground, the extremities of many of the native troops became gangrenous from frostbite, several were already dead from exposure. On the 8th, in traversing the

[1] The Political Officer had recommended that the horse cloths should be cut up to provide leg coverings for the sepoys but his advice was not regarded.

Khurd Kabul pass, three thousand were shot down or knifed by the Pathans, others gave up their arms without resistance and were clubbed on the head. Akhbar Khan, the sirdar, who had guaranteed the safety of the force, had undertaken more than he was able, or perhaps willing, to perform, but on the 9th he made the suggestion that the British women and children, including Lady Macnaghton and Lady Sale, should be handed over to his protection. They, with some of the husbands and one or two wounded officers, were accordingly surrendered, and, after months of wandering, though without maltreatment, rejoined the army. On the 10th, in passing a gorge, the remaining sepoys perished and, save the British and a handful of the 5th cavalry, no fighting force was left. The transport was all gone, the kahars had been massacred or died of exposure, and the khajawah camels had been carried off. A few wounded had secured cavalry chargers. Dr. Alexander Bryce of the Artillery was killed on this day. Magrath of the 37th was wounded while trying to rally some of the cavalry to rescue his patients who were surrounded by the Ghilzais. He owed his life to an Afghan to whose family in Kabul he had rendered some small service, and later joined Lady Sale's party. Duff, the superintending surgeon, had been severely wounded in the hand, which, during a short halt at Tezin, was amputated with a penknife. Here the last remaining gun was abandoned, and Dr. Cardew, who had been mortally wounded at the dip of the Tezin Nala was laid on the carriage to await death. The survivors pushed on by night. Duff, weakened by his injuries, fell behind and was cut down. On the 11th, Jagdalak was reached. The political officers had already been seized as hostages, and the Afghans now demanded that the General, who was a dying man, and Brigadier Skelton should be handed over. The latter had up to the present by almost superhuman effort managed to maintain some sort of military resistance. Brigadier Anquetil of the Shah's contingent was killed soon after, and the survivors were leaderless.

Some 350 men entered the Jagdalak pass. The far end was blocked by a barrier, and the enemy closed in behind. At this point Surgeon Harcourt of the 44th was killed. The barrier was carried, but only twenty officers and 45 British other ranks came through. A few of these, including Drs. Brydon and Harpur, with Balfour of the 44th, continued on the road towards Nimla, the remainder made a last stand on a little hillock just off the road near the village of Gandamak. An officer and a drummer survived as prisoners, the others, among whom was Primrose, the other assistant surgeon of the 44th, died where they stood. Of those that went on, Brydon, Harpur and four others reached Fatiabad, 16 miles from Jalalabad, where they were treacherously attacked by villagers. Brydon alone, wounded and on a dying horse, reached the town—the remnant of an army.[1]

[1] Dr. William Brydon served with distinction in the Indian Mutiny during the siege of Lucknow. He received the C.B., died 1873.

The siege of Jalalabad lasted till April 16, during which time the garrison never seem to have been very severely pressed. There was an Indian infantry brigade at Peshawar and some Sikh regiments, but the latter not only had no intention of advancing through the Khyber, but undermined the loyalty of the British sepoys. When Sir George Pollock arrived from India with reinforcements in February, he found the troops dispirited and mutinous; sickness was rife, and there were 2,000 men in hospital. He eventually forced his way through the pass and concentrated his forces at Jalalabad. Sir Robert Sale in his despatch describing the siege referred to the meritorious services of Surgeons Forsyth, Hare and Brown of the Indian Army and Assistant Surgeons Robertson and Barnes of H.M. 13th Light Infantry. Meanwhile General Nott at Kandahar not only held his own, but took his brigade into the field. Among his troops was the 40th Foot whose surgeon, J. MacAndrew, when at Deesa the previous year, had been congratulated in General Orders on having the lowest mortality among his patients of any regimental surgeon in India. He was now the S.M.O. of the Brigade.[1] During the General's absence in March a strong attack was delivered on the depleted garrison, when ninety of the sick in their hospital blue turned out under the Quarter-master and gallantly defended the threatened gate. In May, Nott was reinforced by a brigade under General England including the Welch Regiment, which fought its way through the Khojag Pass. The garrison of Ghazni were compelled to surrender on March 6th.

At Jalalabad, General Pollock's movements were hampered both by want of transport and a fresh outbreak of sickness. The foul state of the camping ground, which could be smelt three miles away, gave rise to dysentery, from which the men are described as dying by hundreds. He marched at length on September 7, and, after engagements in the Jagdalak Pass and at Tezin, reached Kabul on the 15th where he was joined by Nott. A few days later the prisoners of Lady Sale's party were recovered, with whom were Assistant Surgeons Campbell, Berwick, Magrath and Thomas Thomson, the M.D. of the Ghazni garrison; the sick left behind by Elphinstone appear to have suffered no harm. The Grand Bazaar was blown up, and on October 11, 1842 the two divisions set out on their return to India. With them went 2,000 miserable natives, survivors of the retreat, who had become beggars in the streets of Kabul, the great majority of whom had lost hands or feet from frost-bite.

To the medical student of this depressing and disastrous campaign, so damaging to our military prestige, certain features are sufficiently obvious. The horde of undisciplined followers who accompanied the army proved

[1] Sir John MacAndrew, M.D., K.C.B., joined the army as a Hospital Assistant in 1809, and served in the 9th Light Dragoons, Royals, 14th and 40th Regiments. His war service included Walcheren 1809, Peninsular 1811-13, Afghanistan 1841-2, Maharajpore 1843, Indian Munity 1857-8, including the siege of Delhi and capture of Lucknow. He retired in 1858.

its bane in that effective camp sanitation was impossible. Their conduct moreover during the retreat contributed greatly to the panic which beset the Indian troops. The fact that it is uneconomical to allow enrolled public followers to die of exposure among the frontier hills owing to inadequate clothing seems hardly to have been realized till Sir Frederick Roberts called attention to it during his campaign thirty-seven years later, and it was another forty years before the matter was efficiently dealt with. The lines of communications as usual provided the source of much sickness. Dysentery was prevalent throughout, and conditions at Quetta and Jalalabad were deplorable. The staff organization in Scinde was sketchy, if indeed it could be said to exist. Efficient central control could have obviated much of the mortality from heatstroke among the detachments marching up. Some of these problems still recur, though perhaps in a less acute form. We now at any rate have the staff organization to deal with them if only it is properly employed.

Medical Officers serving with British Troops in Afghanistan, 1839-1842.

Sir John Keene's Army.

Superintending Surgeons of the whole force: Richard H. Kennedy and James Atkinson (H.E.I.C.'s Service); 4th Light Dragoons (Hussars), Assistant Surgeon John Stewart Graves; 16th Lancers, Surgeon William Ramsay White, Assistant Surgeons, John Strange Chapman, M. J. Maclaine Ross (Medical Storekeeper Bengal Column); 2nd Queen's, Assistant Surgeons Robert Home Alston Hunter, W. E. Hibbert (died); 13th (Somerset L.I.), Assistant Surgeons John Robinson, George West Barnes; (17th Leicestershire Regt.), Surgeon Alexander Hamilton (died), Assistant Surgeon James Smith; 1st Bengal Europeans (Munster Fusiliers), Surgeon John Paton (H.E.I.C.'s Service), R. M. M. Thomson (do. Field Surgeon Bengal Column).

Kabul Garrison, 1841.

Superintending Surgeon William Duff (H.E.I.C.'s Service, killed); 44th (1st Essex Regt.), Surgeon John Harcourt (killed); Assistant Surgeons William Balfour (killed), William Primrose (killed).

General Nott's Force.

40th (1st S. Lancs), Surgeon John MacAndrew (S.M.O.), Assistant Surgeons Henry Mapleton, Eneas Mackintosh Macpherson; 41st (Welch Regt.), Surgeon William Wilkins, Assistant Surgeons Arthur Charles Webster, William Home Fairbairn, David Stewart.

General Pollock's Army.

Superintending Surgeon W. S. Stiven (H.E.I.C.'s Service); 3rd Light Dragoons (Hussars), Assistant Surgeon, Nelson Dartnell; 9th (Norfolk Regt.), Assistant Surgeons Robert Harthill, William Harvey; 31st (1st East Surrey), Surgeon Henry Hart.

Hon. East India Company's Service.

At least 13 deaths occurred among the Company's medical officers. P. B. Lord, political service, killed at Purwandara, G. M. Grant at Charekur, W. Duff, E. R. Cardew, A. Bryce (Horse Artillery), F. R. Metcalf (5th N.I.), and E. T. Harpur (5th Cavalry) in the retreat, J. Brickwell in the Bolan Pass, 1842. The following died of disease: Surgeon A. Forbes (1st Cavalry) from cholera, J. Halloran (Bombay Foot Artillery) from heat-stroke, J. Walker (42nd N.I.), Carlow and Baines, the last two in Baluchistan.

CASUALTIES, EUROPEAN TROOPS, 1839.

	Strength other ranks	Admissions for disease	Deaths from disease	Killed	
16th Lancers..	463	820	46	65	Returned to India, Nov.
2nd Queens (Royal West Surrey)	568	1.342	74	30	,, to Scinde ,,
13th (Somerset Light Infantry)	502	1,209	70	93	
17th (Leicestershire Regiment)	585	789	55	6	,, to Scinde ,,
1st Bengal Europeans (Munster Fusiliers)	566	1,176	20	28	,, to Jalalabad, Oct.

This gives an admission-rate for sickness of 199 and a death-rate of nearly ten per cent. The figures for five native infantry battalions of the Bengal Army work out at 168 and 3½ per cent.

A Parliamentary Paper (1846 (248), xxxi, 377) was published, showing that after the first year of occupation the sickness and mortality among the troops in Scinde were very high. The Queens and the 17th were in garrison there in 1840, and had 17 and 55 deaths respectively. The following year the 22nd (Cheshire Regiment) had an admission-rate of 3,057 per 1,000, and a death-rate of 178. The average annual death-rate for Europeans, all India, 1831-1856, was 57·6 per mille.

AUTHORITIES.

HOUGH, Major W. "Narrative of the March of the Army."
KENNEDY, R. H. "Narrative of the Campaign."
ATKINSON, J. "The Expedition into Afghanistan."
SALE, Lady. Journal.
FORTESCUE. History of the British Army, vol. xii.

Current Literature.

HANSEN, P. **Developments in Water Purification Practice.** *Engineering News-Rec.* 1930, v. 104, 839-43, 8 figs.

This article is confined to a description of some of the improvements which have been made in the practice of rapid sand filtration. Settlement before the addition of coagulants is generally desirable when handling very turbid waters. As a coagulant, alum has found most favour, but it has the disadvantage of not giving good flocculation if the temperature and hydrogen-ion concentration are unfavourable. Lime and copperas, sodium aluminate and ferric chloride with chlorinated copperas are also used as coagulants for certain supplies. Chlorine has found an additional use in pretreatment in colour removal, in combating organism troubles and in assisting effective coagulation. The use of chlorine in excess prevents the formation of the "phenol" tastes, but such excess must be removed by sulphur dioxide, sodium thiosulphate or potassium permanganate. The application of ammonia before chlorination has been found to prevent the characteristic chlorine tastes. Aeration has been found useful in combating tastes and odours due to organisms. "Active" carbon is found to be remarkably effective in removing both phenol and chlorine tastes from water.

M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 5, *No.* 11.

MAGALHÃES, Mario. Sobre o methodo de Eijkman para o exame bacteriologico da agua. **On the Eijkman Test for the Bacteriological Examination of Water.** *Archivos de Hyg.* Rio de Janeiro. 1930, v. 4. No. 2, 5-20, English summary.

Eijkman's method is the employment of a glucose peptone medium to which the suspected water is added in a proportion of 1 to 8 and incubation carried on at 46° C. It is claimed that in 18 to 24 hours a distinction can be made between *Bact. coli* from cold or warm-blooded animals. Further, it is selective for *Bact. coli* and inhibits the common water organisms, and bears a strict correlation with the American tests of indol production, the citrate and uric acid reaction, while occupying less time, and may thus prevent condemnation of waters which have come under suspicion owing to the presence of *Bact. coli*, when these are of non-human and cold-blooded origin.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 5, *No.* 11.

Tomb, J. W. **Observations on the Stability of Chloride of Lime, "Stabilized" Chloride of Lime, and Perchloron in the Plains of Bengal.** *Far Eastern Ass. Trop. Med. Trans. Seventh Congress, British India.* 1927, v. 3, 553-66.

The addition of 20 per cent. dry quicklime to bleaching powder has been stated to "stabilize" the chloride of lime so that it remains dry and powdery in hot climates, does not corrode tins and only loses a very small proportion of its available chlorine when exposed to the atmosphere. The investigations here described indicate, however, that although the first two claims are valid, such a mixture deteriorates more rapidly at all seasons than does the simple product. The use of the German "Perchloron" in hot climates is recommended. Its price is double that of bleaching powder, but its available chlorine content is also double and it deteriorates at a much slower rate than chloride of lime.

M. E. Delafield.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

Cutler, J. W., & Green, F. W. **Operating Experiences with a New Automatic Residual Chlorine Recorder and Controller.** *J. Amer. Water Works Ass.* 1930, v. 22, 755-66, 7 figs.

Automatic control of chlorination is far better than manual control, but has hitherto not been perfect, for although it can compensate for changes in flow, it does not allow for any variation in the chlorine consumption of the water itself. The apparatus, here described in some detail, estimates the residual chlorine automatically and this record is used to control the chlorinator. The principal of the device is to make use of a special type of photo-electric cell which measures the amount of residual chlorine by its own response to the light passing through a sample of the chlorinated water to which orthotolidin has been added. There are four principal parts to one cycle of the apparatus which is driven by an electric motor: (1) a light source provides illumination in a manner which enables the photo-electric cell to measure and compare the colour of the solution; (2) a mechanical relation is set up which corresponds with this measurement; (3) this mechanical relation operates the recorder and adjusts the chlorinator; (4) the apparatus automatically obtains new and fresh samples of treated water and adds the proper amount of orthotolidin at the proper point. The results of the use of the apparatus are stated to be excellent. It may also be used as a warning of approaching pollution by placing the machine upstream and a chlorinator controlled by the apparatus far enough downstream to protect the water supply when the controller indicates the need for increased chlorination.

M. E. Delafield.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

WILLIAMS, L. O. **Red Water Trouble and the Remedy at West Palm Beach.** *J. Amer. Water Works Ass.* 1930, v. 22, 791-5.

Severe corrosion of the iron pipes resulting in a red water supply was here due to an excess of carbon dioxide liberated by the alum used for removing the colour of the raw water. The presence of dissolved oxygen in an amount of 9 p.p.m. rendered this carbon dioxide highly aggressive. The cure was found to lie in increasing the alkalinity of the water to about pH 9 by the addition of lime. If the amount of lime was reduced to a figure which made the reaction pH 8·1 the trouble reappeared. After the lime treatment the pipes show a deposit of calcium carbonate over the coating of rust and embedded in it. The entire rust surface has not been covered, but the existing rust scale is considerably harder and more resistant than before lime treatment.

M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

CARRIER, W. H. **The Control of Humidity and Temperature as applied to Manufacturing Processes and Human Comfort.** *Domestic Engineering.* 1930, v. 50, 111-15; 122-5, 2 figs. [22 refs.]

The author, speaking with authority, as one of the pioneers of the science of air-conditioning, surveys the wide field of its development into the "Art of control of atmospheric conditions within an enclosure." He initially discusses its growing importances in industry, especially in those trades needing exact conditions of relative humidity (R.H.) such as production of pig-iron and flour, or manufacture of chocolates, cigarettes or artificial silk—in the last of which 1 per cent. difference in moisture involves a difference of millions of dollars on sales. He cites also its influence upon output, not only by promoting individual efficiency, but by enabling cotton manufacture to be transferred from the Northern to the Southern States where the cotton is grown and labour is cheap. And he notes its contribution to human pleasure and comfort in homes and places of amusement.

Turning to its history, he dates the definite control of R.H. as from 1905, when cold-spray dehumidification was introduced in lieu of exposure of air to cold pipes—the residual water vapour remaining after condensation by cooling to near zero being sufficient to give only a low R.H. when the same air is subsequently warmed without contact with water. But only in 1923 was this method successfully applied to control of both temperature and R.H. of air supplied to theatres, by adjustment between coldness of the water-spray and heat of the warming device to which the air is exposed before being delivered through the air inlets of the auditorium.

The next section deals with the physical principles involved, which are reduced to a profusion of formulæ affording a veritable godsend to the ardent mathematician. They tend to facilitate calculations by correlating

the various factors essential to human comfort with the associated physical conditions of temperature, pressure, velocity, etc. There are usefully added a curve of specific weights of water-vapour and a chart of heat transmission by evaporation. The points of less mathematical and more general interest which emerge are :—

(*a*) " The properties of saturated water vapour are assumed to be in no way affected by the presence of other gases" (in air).

(*b*) The fundamental principles in air-conditioning are thus summarized :—

" (1) When dry air is saturated adiabatically [*i.e.*, without the aid of any external energy] the temperature is reduced as the absolute humidity is increased and the decrease of sensible heat is exactly equal to the simultaneous increase in latent heat due to evaporation.

" (2) As the moisture content of air is increased adiabatically, the temperature is reduced simultaneously until the air is saturated, when no further heat metamorphosis is possible. This ultimate temperature may be termed the temperature of adiabatic saturation.

" (3) When an insulated body of water is permitted to evaporate freely in the air, it assumes the temperature of adiabatic saturation of that air and is unaffected by convection, *i.e.*, the true wet-bulb temperature of air is identical with its temperature of adiabatic saturation.

" (4) The true wet-bulb temperature of the air depends entirely on the total of the sensible and the latent heat in the air and is independent of their relative proportions. In other words, the wet-bulb temperature of the air is constant providing the total heat of the air is constant."

(*c*) " In cooling and dehumidifying air, it is necessary to take into consideration not only the sensible heat of the air itself but [also] the latent heat of the moisture removed."

(*d*) " For a fixed per cent. of relative humidity there is substantially a constant difference between the dew-point and the dry-bulb temperature." This permits the use of a differential thermostat, responsive to both room and dew-point temperatures, for automatic control of relative humidity in a room or factory.

(*e*) "For human comfort, the range of satisfactory and practicable humidities is between 35 and 65 per cent.," the latter being a summer maximum and the former a winter minimum. (*Note.* This refers, of course, to the U.S.A.)

A R.H. of less than 30 per cent., such as is induced by warming out-door air from zero to 70° F. in room interiors, raises the death-rate by at least 10 per cent.

The maximum industrial output is obtained with a R.H. of 60 per cent. at temperatures ranging from 65° to 70° F.

(*f*) "Under ordinary room temperatures the threshold of perceptibility of air currents on the exposed surfaces of the body averages about 4-5 ft. per minute.

(*g*) "Published preliminary data indicate that the heat-loss from the human body by convection is roughly one-third less than the loss by radiation in still air [at] ordinary room temperatures."

(*h*) Data are given of the value of installing refrigerating and ventilating plant in the Moro Velho Gold Mine thus :—

Period re-installation	Dry bulb temp.	Wet kata	Fatal accidents	Output
16 months prior	101·5° F. ..	7·7 ..	20 ..	—
16 months subsequent ..	76·2° F. ..	20·5 ..	6 ..	+ 12 per cent

P. S. LELEAN.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

DIXON, T. P. **Air Pollution in Cinemas.** *Domestic Engineering.* 1930, v. 50, 134-5. Also in *J. Roy. San. Inst.* 1930, v. 50, 692-5.

This article gives some results of the author's considerable practical experience in inspecting Middlesbrough cinemas, including a very interesting table correlating sensations with a number of relevant factors. The worst conditions were found in galleries, which he would eliminate.

His experience confirms the applicability of kata standards of 6 dry and 13 to 18 wet, and finds them more difficult to secure owing to the practice of closing doors when "talkies" are showing, and obstructing inlet ventilators because of cold.

He recommends that it be made compulsory to provide exhaust fans in shafts opening above roof-level ; that one-third of the roof of the auditorium be made to open ; and that there should be free flushing with fresh air of all cinemas between performances.

P. S. LELEAN.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

CAMPBELL, J. A. & ANGUS, T. C. **Some Physiologic Reactions to Cooling Power during Work, with special Reference to Evaporation of Water.** *J. Indust. Hyg.* 1929, v. 11, 315-27. [7 refs.] [National Inst. for Med. Research, Hampstead, London.]

The practical indications of this research are summarized by these workers thus—"Greater use should be made of removal of clothing and movement of air to render conditions comfortable for indoor muscular workers. If this is done, there is a wide range of atmospheric conditions above and below 15° C. (59° F.), under which comfort is attained with moderate work."

The effects upon the lightly clothed of moderate work (12,000 kg.-metres per hour) in still moist air were as follows, as atmospheric temperatures rose from 10° to 25° C. :—

Pulse=a progressive increase, rapidly augmenting to an addition of 20 beats per minute between 20° and 25° C. (68° and 77° F.).

Tempr. = a slight increase of rectal temperature usually amounting to only 1° F. at 77° F. Cheek temperature is modified by other factors.

Evapn. = a rapid increase occurs as temperatures approached 20° C.; at 25° C. the average of 30 cc. for the resting man reached 176 cc.

Other observed effects were that:—

Wind, of 100 to 130 ft. per minute, reduced body temperature, evaporation and pulse-rate.

Removal of clothes greatly reduced evaporation—which fell almost to zero when atmospheric temperature fell below 20° C.

Dry kata readings of between 4 and 14 connoted comfort.

One other useful datum is that the weight of clothing of the average industrial worker is about 3 kilogrammes (6½ lb.).

P. S. Lelean.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

Reviews.

Tropical Medicine. By Sir Leonard Rogers and Major-General J. W. D. Megaw. London: J. and A. Churchill. 1930. Pp. vii + 536. Price 14s.

This textbook differs from the generality of works on the subject, in that it is written for the practitioner who has no laboratory behind him, and who consequently has to rely on his own resources. For this reason details of pathology and parasitology which can be demonstrated only in a laboratory are omitted and replaced by simpler methods of diagnosis within the scope of the general practitioner who can use a microscope.

The authors have adopted a convenient mixture of systematic and clinical classification of diseases, amœbic dysentery, for example, being placed not with other protozoal infections like kala-azar, but in the section on bowel ailments, just where the practitioner freed from the tyranny of examinations would group it himself. With the exception of some minor and unimportant conditions, the book ranges over the whole field of tropical medicine, and the various diseases included are dealt with in an eminently practical and common-sense fashion, as is admirably exemplified in the chapter on malaria which is a model of sound precept and clear exposition. While diagnosis and treatment receive the special attention they merit, ætiology and prevention are also included, and the succinct accounts of outstanding events in the development of our knowledge are interesting and helpful.

A most instructive chapter is that on the incidence of general diseases in the tropics which brings out the fact, often forgotten by students of tropical medicine, that two-thirds of the deaths in a city like Calcutta are

due to cosmopolitan diseases. In this chapter the authors analyse a large series of post mortems made in Calcutta, and compare the results with those found in London. In Calcutta, fatal cases of phthisis are shown to be three times more numerous, and deaths from lobar pneumonia four times more numerous, than in London. On the other hand, reliable evidence of the occurrence of rheumatic endocarditis in Bengal is still lacking, so that deaths from mitral valve disease are only about one-fifth of those in London; whereas fatal involvement of the aortic valve is equally common in both cities. Of the Calcutta mitral stenosis cases, half showed syphilitic atheroma, indicating that syphilis and not rheumatic fever was the causal factor.

The volume concludes with a chapter on the use of the microscope, which, like every other part, is full of information and practical hints.

THE ACTION OF MUSCLES. By Sir Colin Mackenzie, M.D., F.R.C.S., F.R.S. Second Edition. London: H. K. Lewis and Co., Ltd. 1930. Pp. xvi + 288. Price 12s. 6d.

This is a book that should be in the hands of all who have to deal with "paralysis of muscle," a term that the author points out is too loosely applied. The anatomy and comparative anatomy given cannot fail to assist in arousing a new interest in the understanding of muscle function.

The table showing just what the patient can, and cannot, do in the various nerve palsies is of special value.

Well illustrated, written in a very attractive style, the book is delightful to read and cannot fail to stimulate interest in a subject so vital to the patient and his surgeon.

There are many useful hints given in regard to the necessary postural treatment of paralysed muscles, each designed to put the affected muscle completely at rest, the most important factor in any possible recovery. The author lays stress on the futility of ordering massage, etc., in any paralysed muscle unless recovery is taking place. His "volitional test" as an indication of the amount of loss of function in a muscle is extremely practical.

It is impossible to recommend the book too strongly.

J. H. M. F.

SHORTER CONVALESCENCE. By Lieutenant-Colonel James K. McConnel, D.S.O., M.C. London: Wm. Heinemann. 1930. Pp. xi + 132. Price 5s.

In this book the author describes methods "to improve the patient's muscular co-ordination and tone whilst still in bed," and claims that his methods are such as to lead to a shorter convalescence after serious illness.

Preliminary to giving us the detail of his exercises, the author deals

with much physiology and comparative anatomy, all of which is well written.

The exercises are intelligent and easy to follow, but if one might criticize, a tabulated arrangement would be of assistance to masseurs who have to use them.

In his preface the author states that his inspiration has been Sir Thomas Horder's remark, "that no amount of massage, no amount of electrical stimulation of whatever kind, has the same physiological value as the natural movement carried out by the patient under supervision and careful guidance." I consider this the most valuable paragraph in the book.

The book is not easy to read, and is therefore of limited value to masseurs and nurses. It does, however, give much food for careful thought on the part of medical men who deal with serious illness and its necessary confinement to bed.

HANDBOOK OF THERAPEUTICS. By David Campbell, M.C., M.A., B.Sc., M.D. Edinburgh: E. and S. Livingstone. 1930. Pp. xviii + 411. Price 12s. 6d.

A very readable and well-printed book giving in a handy form clear directions on that all-important subject, the treatment of the patient. It gives help and guidance to the practitioner of medicine who thinks of trying for himself all the new and much vaunted drugs written up in the current literature. As the author rightly points out in his introduction, "The man who is patron of all drugs will too often be found not to be a master of a single remedy."

The great majority of our patients desire above everything else to get well; to them diagnosis and even prognosis are comparatively uninteresting, and though the medical student, early in his career, may feel inclined to give treatment but scanty attention, he soon finds out his mistake when he takes up general practice. We can thoroughly recommend this little book to all whose work entails the treatment of the sick.

A. C. H. G.

STEPPING STONES TO SURGERY. By L. Bathe Rawling, M.B., B.Ch., F.R.C.S. London: H. K. Lewis and Co., Ltd., 1930. Pp. xvi + 228. Price 12s. 6d.

In these lazy days there are many who fight shy of sitting down with a textbook of anatomy to work out, say, the intimate anatomy and mechanics of the reduction of a dislocated shoulder. But there can be no excuse now for not knowing such facts, for Mr. Rawling has done the spade work for us.

In the book under review only certain subjects are dealt with, but as they run from a case of dislocated shoulder to one of acromegaly and many others of like interest, I do not think we can complain. Further, Mr.

Rawling promises us some more, and if the next volume is as good as this one, the sooner he sits down to do some more spade work for us, the better.

The book consists of a number of cases which are described very briefly from the surgical aspect and very fully from the anatomical point of view. No one can fail to conceive a new interest in anatomy after reading this book. It is eminently practical and also easy to read. The illustrations are worthy of more than a passing mention, as they have the great merit of being unspoiled by too much detail.

A few anatomical slips are noted, e.g., on page 8 external epicondyle should read internal epicondyle. Also the ulnar nerve is described as passing to the inner side of the pisiform bone.

The book is of especial value in that it throws a blaze of anatomical light on the clinical case we are always meeting in the wards.

Mr. Rawling is to be congratulated on a very useful volume.

J. H. M. F.

THE MYCOSES OF THE SPLEEN. By A. G. Gibson, M.D., F.R.C.P. A volume in the Anglo-French Library. London: Kegan Paul, Trench, Trübner and Co., Ltd. 1930. Pp. xii + 169. Price 12s. 6d. net.

Some sixteen years ago the writer of this book put forward the suggestion that certain forms of splenomegaly which are included in the terms splenic anæmia and Banti's disease are the result of the invasion of the spleen by a streptothrix. Since then he has continued his studies and has been led to include the condition known as acholuric jaundice in the group. Though the results of his observations are not put forward as conclusive, they have served to strengthen his belief in the mycotic origin of these diseases.

Recent work in France has aroused special interest in this line of research, and this book is an attempt to state the case as it now stands.

Dr. Gibson discusses the evidence from the point of view of ætiology, clinical observation, morbid histology and experimental research. He gives detailed accounts of the examination of spleens removed by operation and at autopsy. In certain of these he has found in sections what he believes to be mycelial elements of a streptothrix. From some spleens he has succeeded in cultivating a streptothrix which appears to have a pathogenic action on monkeys. To this he has given the name *Nocardia splenica*.

The possibility of fallacies due to the difficulty of interpreting microscopical appearances in sections and of accidental contamination of tissues and cultures are fully considered.

In the latter part of the book the work of a number of French observers is reviewed. Among these Professor Nanta claims to have found in the spleen a fungus which he places in the genus *Aspergillus*. Dr. Gibson

regards the French reports as supporting his theory that certain splenomegalies may have a mycotic origin and pleads for further research.

The book is well written and full of interest, and the reader feels that the arguments are presented fairly and in the spirit of the true research worker who realizes his own limitations and is careful to avoid rash conclusions. We think that the author has definitely made a case for further investigation on the same lines.

C. J. C.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LIST OF BOOKS RECEIVED DURING THE PERIOD FROM JULY 1 TO SEPTEMBER 30, 1930.

Author	Title of Work	How Obtained
Scott..	The Morphine Habit	Gift. Library and Journal Committe
Stopford	Sensation and Sensory Pathway ..	,, ,, ,, ,,
Miles..	Cancer of the Rectum	Library Grant
Marlow	Law and Industry	,, ,,
Buchanan	Manual of Anatomy. 3 vols.	,, ,,
Walker	Inspection of Game, Fruit and Fish and Vegetables	,, ,,
Chandler	Hookworm Disease	,, ,,
Partridge	Aids to Chemistry	,, ,,
Walker	Male Disorders of Sex	,, ,,
Groves	A Synopsis of Surgery	,, ,,
Currie	A Textbook of Hygiene	,, ,,
Conybeare	A Textbook of Medicine	,, ,,
Walker	Pioneers of Public Health	,, ,,
Philadelphia Committee on Drug Addiction	Opium Addiction	Gift. Authors
Jones	Injuries to Joints	Library Grant
Crowe	Vaccine Treatment of Chronic Rheumatics	,, ,,
Henderson & Henderson	A Dictionary of Scientific Terms ..	,, ,,
Haslam	Recent Advances in Preventive Medicine	,, ,,
Fairbairn	Textbook of Midwives	,, ,,
Ten Teachers	Diseases of Women	,, ,,
Jameson & Parkinson ..	A Synopsis of Hygiene.	,, ,,
Patel..	Infectious Diseases, of India	,, ,,
Craig..	Laboratory Methods of U.S. Army ..	,, ,,
Birdwood	Clinical Methods in Tropical Medicine ..	,, ,,
Rorie..	A Medico's Luck in the War	Gift. Library and Journal Committ
Pottle	Stretchers. A Story of Hospital on Western Front	,, ,, ,, ,,

Notices.

THE TERCENTENARY OF QUININE.

A Cinchona Tercentenary Celebration has been organized at the Wellcome Historical Museum to mark the first recognized use of cinchona bark by Europeans.

An extensive collection of exhibits has been arranged to illustrate the romantic history of this remarkable remedial agent, the addition of which to the world's materia medica has, for three hundred years, proved itself to be of incalculable value, especially in tropical regions. The lives of untold millions have been saved by the use of cinchona bark and its active principles.

From the time when the therapeutic properties of cinchona bark became known to the Old World, until, and since, the scientific researches resulted in the discovery of quinine and other derivative constituents by Pelletier and Caventou and others, there have occurred many interesting phases in the history of cinchona.

The distinguishing botanical name of the genus *Cinchona* was invented by Linnaeus. This title was suggested by the titular name "Chinchon" of the Countess Francisca Henriquez de Ribera, the Vice-reine, and second wife of the Viceroy of Peru. The Vice-reine was cured of fever at Lima by the administration of cinchona bark prescribed by the Court Physician, Dr. Juan de Verga.

Linked up with the history of cinchona bark are the pioneer exploring expeditions of the venturesome Spaniards in South America, its introduction to all parts of the world, especially by Jesuit missionaries, and also the later research expeditions of French, Spanish, British and other scientific investigators.

This Exhibition illustrates in outline the historical development from the time of the introduction of the bark until to-day, when experimental researches on its active principles are still being continued.

Receptions were held on December 8, 10, 15 and 17, and the speakers included the Spanish Ambassador, French Ambassador, Peruvian Minister, Sir Humphry Rolleston and Sir David Prain.

WANTED.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1, payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C. 2.

VOL. LVI. FEBRUARY, 1931. No. 2.

Journal

of the

Royal Army Medical Corps.

Original Communications.

SIMPLIFIED METHODS OF BLOOD EXAMINATION IN TUBERCULOSIS WITH EXAMPLES OF THEIR APPLICATION IN CASES.

COLONEL S. LYLE CUMMINS, C.B., C.M.G.

NONE of the tests about to be described can be called diagnostic for tuberculosis. All of them are measures of the general systemic state of the individual and they vary from the normal in all serious constitutional disturbances, whether connected with disease or merely with physiological stress. Tuberculosis, however, has the peculiar character of leading, in many cases, to profound constitutional disturbance without much apparent change in the outward health of the sufferer, and any method capable of bringing to light this often unsuspected deterioration in health may be of great importance. Further, while it is true that no single one of these blood-tests is diagnostic, it is also true, as the following reports will show, that, taken together, the results of the blood-sedimentation test, the Arneth Index as expressed according to the Von Bonsdorff technique, the lymphocyte-monocyte ratio and the enumeration of the total leucocytes can go far to establish a diagnosis. Apart altogether from diagnosis, however, the greatest importance of these tests lies in their value as indicators of the constitutional state of a patient at any given moment, and, when used at intervals, of the progress of a case under treatment. Nor is their application confined to tuberculosis. In all prolonged infective processes and in all chronic diseases, they are of great utility; and, requiring but little apparatus and being capable of great simplification, they are eminently suitable for use under military conditions.

The Blood-sedimentation Test.

This test, first described by Fähraeus (1918) (Fähraeus, *Hygia*, 1918, No. 7, p. 369), in connection with pregnancy, was found by him to afford much information, also, in cases of tuberculosis. It depends on estimating the rate of sedimentation of the red corpuscles in a column of citrated blood. As to the biochemical and biophysical factors which underlie this test, those interested should consult the classical paper by A. Westergren (1924) on "Die Senkungsreaktion" (Westergren, A., *Ergebn. d. inn. Med. u. Kinderh.*, Band xxvi, p. 577), in which the theories to explain increased rapidity of fall of the erythrocytes are set forth.

Here it will suffice to say that the increased rate of fall appears to go with an increased amount of fibrinogen in the plasma and, in all probability, with an increased amount of the products of cell degeneration such as are produced in caseo-necrotic processes.

In tuberculosis and in allied conditions the rate of fall of the erythrocytes, as represented by the height of the column of red cells in relation to the total height of the column of citrated blood-fluid, and in relation, also, to the time elapsed since the setting up of the test, is found to vary directly with the severity of the constitutional disturbance.

Westergren employs for the test glass tubes of standard calibre, graduated up a height of 200 millimetres; and he collects the blood from a vein into a syringe containing the appropriate amount of 3·8 per cent solution of sodium citrate to make a mixture of one part of citrate solution to four parts of blood. This volume of citrated blood is transferred to the calibrated glass tube, and the latter set up vertically in a special type of stand provided with pressure clips to occlude the openings of the tube and retain it in the vertical position without any loss of fluid. Where, however, a large number of tests have to be performed, the operation of vein puncture takes a long time, involves the use of numerous sterile syringes, of a large number of calibrated glass tubes and a supply of expensive stands in which to stand them in position; nor is it always easy to persuade a nervous patient to submit to the puncture of a vein.

Under these circumstances, the writer has devised a simple micro-technique, applicable to a small volume of blood obtained by pricking the finger.

The simplified test is as follows:—

Apparatus and Reagents Required.

Solution of 3·8 per cent sodium citrate in distilled water.

Supply of "paraffined" microscope slides prepared by dipping the slides into molten paraffin (melting at 52° C.) and allowing them to dry.

Watch glasses.

Capillary pipettes, drawn out in the flame from lengths of glass tubing in the usual way, and with rubber teats to fit.

A supply of specially prepared glass tubes, each about ten centimetres

Taking the pipette by the teat, draw up one "volume" of citrate solution, a small supply of which has been poured out in a watch glass ready for use.

Admit an air bubble to mark off the "volume" of citrate and then draw up into the same pipette four successive "volumes" of blood, directly from the finger-puncture, each separated from the last by an air bubble.

Blow out the blood and citrate volumes from the pipette on to a paraffined glass slide and mix until homogeneous.

Take one of the "special" glass tubes, fitted *over the narrowed end,* with a length of well-fitting rubber tubing.

Holding the end of the rubber tubing between the lips, apply the thick end of the glass tube to the mixed blood and citrate on the paraffined slide and suck up a column of the mixture to the five cubic-centimetre mark.

The column of blood is approximately five centimetres in height and this column is now drawn clear of the end and the tube brought into the horizontal position so that there shall be no tendency for the blood-mixture to "pour" in either direction. The length of rubber tubing is now carefully removed and the narrowed end of the glass tube is sealed off in the Bunsen or spirit flame.

The tube, with its column of blood-mixture now held in position through the sealing of one end, is placed, open end upwards, in the special "stand," in a vertical position.

The height of the blood-column, which should be about fifty millimetres b utis sure to vary a little on either side, is now read off by means of the scale and noted, as is also the exact time at which the tube was set up in the rack.

The blood-cell column gradually shortens, leaving a clear length of plasma above it. The height of the red-cell column is read at intervals, appropriate times being one hour, five hours and twenty-four hours after the setting up of the test. The height of the blood-cell column at each reading is noted and is recorded as a percentage of the total height of the column of citrated blood-fluid.

Thus, in a series of persons examined :—

Times of "readings"	Normal male aged 25		Tuberculous male		Tuberculous female	
	Actual height of blood-cell column	Percentage readings	Actual readings	Percentage readings	Actual readings	Percentage readings
At start of test	48 mm.	100	50 mm.	100	51 mm.	100
After 1 hour	42 mm.	87	29 mm.	58	29 mm.	57
After 5 hours	39 mm.	82	18 mm.	36	21 mm.	42
After 24 hours	24 mm.	50	16·5 mm.	33	18 mm.	35

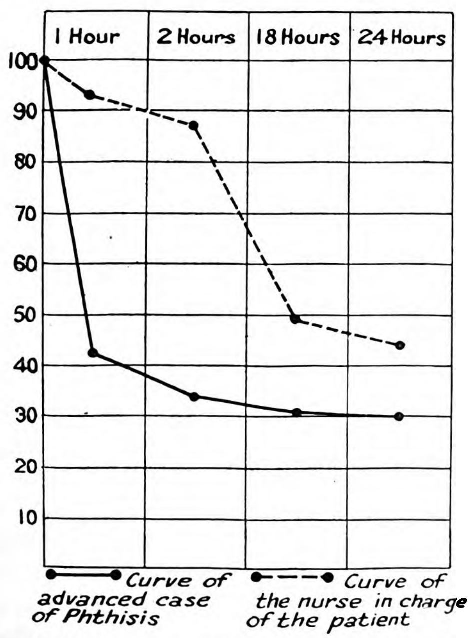
These cases are merely taken at random from a series of observations. It is usual for the fall of red cells to be more rapid in normal females than in normal males, and the same inequality exists between otherwise comparable cases in disease. It is to be noted, too, that the sedimentation is more rapid than usual in females at the menstrual periods and that it is greatly accelerated during pregnancy. It is, in short, a better test in males than in females, so far as concerns tuberculosis, although it is quite applicable to the latter when possible sources of error have been excluded.

The rate of sedimentation in severe tuberculosis is very rapid at first, and becomes slower and slower as the column of red cells shortens and the corpuscles " ball up " and support each other.

The most striking differences between abnormal and normal bloods are seen after a period of from half to one hour. At the end of twenty-four hours the differences are less marked but are still quite definite. It is unusual for the column of red cells in " normals " to fall below half the total height of the column of fluid within twenty-four hours of the test, whereas it often falls as low as one-third or even a quarter of the total height in severe cases of tuberculosis.

The graph, reproduced below, which represents a typical observation made by the writer, serves to illustrate the order of difference to be found between tuberculous and normal persons :—

Graph I.—Red Blood-cell Sedimentation Test.



The curves represent the height of the column of red cells expressed as a percentage of the total height of the column of citrated blood fluid.

Where large numbers of observations are being made on the same day, it may prove difficult to carry out readings at the intervals set forth in the above graph. It is now the writer's custom to make readings at one hour, five hours and twenty-four hours. Where time presses and only one reading is possible, as in cases where the preparations set up in the morning cannot be examined until the afternoon, the five-hour interval proves to be a very convenient and valuable one and has been selected as the best all-round reading in the assessment of cases.

The next method of blood examination which it is proposed to describe is Von Bonsdorff's method of expressing the "Arneth" neutrophile formula. In 1904, Arneth (*Deutsch. med. Woch.*, 1904, No. 2, 54-56, and No. 3, 92-94) published his classical observations on the variations in the distribution of neutrophile leucocytes according to the number of nuclear divisions in each cell. His method of expressing these alterations is known to all. A much simpler, and in some ways more striking, method is that of Von Bonsdorff (*Beitr. z. Klin. d. Tuberk.*, Supplement to Band V, Supplt. 3-5, 1912-13) which consists, not in recording a "swing" to the left, as in the Arneth formula, but in estimating the total number of nuclear lobes in 100 neutrophile leucocytes. In health, this number works out round about 250. Von Bonsdorff records counts of over 300 lobes per 100 neutrophiles, and the writer has met numerous instances of normal persons with counts as low as 225. In cases of constitutional disturbance and especially in tuberculosis, the number may fall very low. Obviously, it cannot fall below 100; but the writer has encountered counts of 110, 109, and even, on one occasion, of 102, in very severe and acute cases of pulmonary tuberculosis in the terminal stages of the disease. It is usual to find that the Von Bonsdorff count is below 200 in phthisical cases, and, while the very low figures referred to above are exceptional, it is not uncommon to meet cases with counts well below 150.

This method can only be employed effectively in blood-films which have been evenly spread and well stained. Officers of the Royal Army Medical Corps, accustomed to making blood-films for the diagnosis of malaria and trained in the use of Leishman's stain, will have no difficulty in successfully applying the Von Bonsdorff technique. Given a well-spread and well-stained film, the next thing is to have a clear understanding as to what shall be accepted as a complete nuclear division. "Young" neutrophiles tend to have band-like undivided nuclei, which may, however, show fairly deep indentations, narrowed portions suggesting impending division, or convolutions which lead to superposition of nuclear material and a false suggestion of division where none yet exists. Thus, unless the observers work on pre-arranged lines, there is room for much individual variation in the interpretation of the appearances of neutrophiles in films.

Von Bonsdorff describes a method of "averaging out," but, in the course of work with post-graduate students, the writer has found the following simple rule to lead to fairly standard results :—

Miss C. M. Acland, in the summer of 1927, two groups were picked out by the writer from the records as "probably unfavourable" and "probably favourable" on grounds of their "sedimentation" tests. In the "probably unfavourable" group were included 27 patients in whom the red-cell column had fallen to fifty per cent or under of the total blood-fluid column in five hours. In the "probably favourable" group were placed those whose red-cell column was not below sixty per cent of the total column in the same period.

The "Von Bonsdorff" results in these two groups are set forth in the form of "frequency curves" in Graph II.

In this graph it is seen that the curve of Von Bonsdorff counts in the "unfavourable" group, expressed as a frequency curve, reached its apex in the column "170-189." No less than sixty-eight per cent had less than 190 lobes in 100 neutrophile leucocytes. In the "favourable" group, only twelve per cent had less than 190 lobes per 100 neutrophiles and the apex of the curve fell in the "210-229" column. A curve illustrating the findings in forty-two non-tuberculous persons is introduced for comparison. It will be noticed that in this healthy group, fifty-eight per cent had Von Bonsdorff counts of over 230 lobes, whereas only twelve per cent of the "favourable" and four per cent of the "unfavourable" cases exceeded this figure.

That these observations on the blood possess considerable prognostic value is shown by the results of a "follow up" in 1929 of the patients grouped as "favourable" and "unfavourable" on blood-tests made in 1927.

CASES TESTED IN 1927: RESULTS OF "FOLLOW UP" IN 1929.

Status according to blood-findings in 1927	No.	Fit for "full work"	Fit for "light work"	Better	I S.Q.	Worse or dead
"Favourable"	26	21	3	2	—	—
"Unfavourable"	26	6	12	4	1	3

Out of the twenty-six cases traced in the "unfavourable" group one was dead, and only six fit for full work; whereas in the "favourable" group none were dead, worse or stationary, and no less than twenty-one were fit for full work.

While the "sedimentation" and "Von Bonsdorff" tests are of great value in prognosis, and while their periodical application affords valuable information on the progress of cases under treatment, they are in no sense diagnostic of tuberculosis. They merely reflect the systemic depreciation which accompanies tuberculosis as well as other chronic diseases or trying physiological states.

A blood-test which approaches nearer to diagnostic significance is one, now to be described, which depends upon the estimation of the relationship

between the numbers of lymphocytes and monocytes as seen in well-made and well-stained blood-films.

Medlar (*Amer. Rev. Tuber.*, 1929, vol. xx, p. 312), whose careful study of the blood in tuberculosis has thrown so much light on the question, expresses the facts underlying this test as follows:—

> "The mononuclear leucocyte (monocyte, S. L. C.) is the chief cell in new tubercle-formation. The lymphocyte predominates when a tuberculous lesion is healing."

Those interested in the significance of cytology in tuberculosis should study the numerous contributions to this subject by Sabin and Doan whose methods of vital staining have been of great importance in relation to some of the fundamental parts of the tuberculosis problem.[1]

Apart, however, from the study of the pathogenesis of tubercles in experimentally infected animals in which vital staining is essential, a great deal can be learnt from the careful study of dried films stained by the Leishman or Giemsa method.

The method used by the writer is to count at least 100 mononuclear non-granular leucocytes and to express as a percentage of the total mononuclears, the lymphocytes, large and small, on the one hand, and the "monocytes" on the other. Thus, in a normal blood, one may expect to find from 80 to 90 per cent of lymphocytes and from 10 to 20 per cent of monocytes. The name monocyte, as here applied, refers to the large mononuclear cells with, as a rule, a horse-shoe shaped nucleus, which are sometimes called "transitional" leucocytes. They are the largest of the leucocytes normally present in the blood, the nucleus, usually but not always of characteristic horse-shoe shape, is looser in texture than the nuclei of the lymphocytes, and the cytoplasm has a peculiar ground-glass appearance and stains a fainter blue than that of either the small or the large lymphocytes. Occasionally, however, a mononuclear cell is encountered which is difficult to place, appearing larger than the average "large" lymphocyte and yet diverging from the typical monocyte type in having a rounded nucleus and a clearer cytoplasm than usual. The more one works at the interpretation of blood cytology, the less one is troubled by these uncertainties, since a habit of mind soon develops as to how to "place" a typical cell. The safest rule is the simple one, "when in doubt, call it a lymphocyte." This rule weights the scales against the monocytes so that any excess of the latter becomes all the more significant.

It should be remembered that an increase of monocytes may be masked by a still greater increase in lymphocytes and that it is only by making direct estimates of the total numbers of each type in a given volume of blood that exact truth can be attained.

---

[1] An important paper by these authors appears in the *Journal Exper. Med.*, vol. xlvi, p. 627, 1927.

There is, however, a decided advantage in being able to work with dry blood-films, which can be so easily made at the bed-side and taken away for subsequent examination, and it must be added that where there is an increase of lymphocytes sufficient to mask the abnormal monocytosis, this fact in itself points to a favourable prognosis.

There are doubtless many pathological conditions besides tuberculosis in which the monocytes increase in proportion to the lymphocytes. The writer has encountered such an increase in a case of pulmonary streptothrix infection, some cases of malignant disease, and in a few cases of senility with bronchitis. In persons suspected of being tuberculous, but in whom the diagnosis has not been definitely established, the finding of a well-marked monocytosis goes far to clinch matters.

Being anxious to put the value of these various forms of blood examination to the test, the writer obtained from a medical friend at Johannesburg, a series of blood-films of native gold-mine workers for investigation. It was arranged that half of the films should be made from known cases of tuberculosis and half from healthy natives, and that the films, each with a serial number for subsequent identification, should be mixed up and sent without any further description. Thus, the writer had the task of examining the films without any knowledge of which came from the sick and which from the healthy. The idea was to ascertain how far the examination of a series of dry films could be used to distinguish the tuberculous from the non-tuberculous group.

Medlar, in the paper already referred to, has laid much stress on the significance of a polymorphonuclear leucocytosis as indicating the presence of acute tuberculosis, on the theory that a progressive tuberculous lesion, being in essentials an abscess formation, evokes a leucocytic response similar to that characteristic of septic processes in general. As the tuberculosis of African natives is usually acute, it was anticipated that an approximation to the "total leucocytes" would help. A method was, therefore, devised in which, by counting the erythrocytes with a small "counting disc" in the ocular of the microscope and the leucocytes with a larger "counting disc," the dimensions of the "field" seen with each counting disc having been ascertained with a micrometer scale, the relation of the white cells to the red cells in a given area of the film could be roughly estimated. The red cells being normally nearly a thousand times more numerous than the leucocytes, it was, of course, convenient to count a smaller number of fields, and to reduce the size of the fields when counting the erythrocytes.

The writer had ascertained, through numerous observations, that the red-cell count is not, as a rule, appreciably diminished in pulmonary tuberculosis, and so it was possible, by taking the red cells at five million per cubic millimetre of blood, to arrive at an approximation of the total leucocytes. Twenty-four dry films from South Africa were examined at Cardiff and three observations made on each, namely, the "total leucocytes,"

the Von Bonsdorff count, and the relation of lymphocytes to monocytes. It may be said at once that the writer, selecting twelve of the films as those probably derived from the tuberculous cases, was right as to ten and wrong as to two.

Here it is only of interest to tabulate the findings under the headings subsequently ascertained from Johannesburg, of "tuberculous" and "non-tuberculous," so that the blood-picture in the former may be clearly seen and the value of examination of blood-films in tuberculosis appreciated.

The findings in the twenty-four films, according to the three criteria applied, are set forth in the following table :—

BLOOD FINDINGS IN A SERIES OF TWENTY-FOUR SOUTH AFRICAN BLOOD-FILMS.

Tuberculous Cases				Non-tuberculous Cases			
Total leucocytes	Von Bonsdorff	Lympho. Per cent.*	Mono. Per cent.*	Total leucocytes	Von Bonsdorff	Lympho. Per cent.*	Mono. Per cent.*
13,652	150	26	74	8,628	240	74	26
45,690	163	42	58	9,000	204	75	25
22,172	200	51	49	10,400	248	73	27
36,113	179	58	42	9,227	258	73	27
5,757	161	58	42	69,726	293	80	20
14,760	179	60	40	11,140	166	83	17
24,892	200	60	40	10,923	230	81	19
9,958	141	62	38	17,980	237	79	21
146.310	205	64	36	9,270	286	80	20
9,652	204	67	33	10,635	204	85	15
18,843	150	68	32	5,718	170	72	28
31,076	170	77	23	7,000	300	76	24

* Per cent. of non-granular mononuclear leucocytes.

It will be seen from the above table that, taking the three tests together, the average picture in the tuberculous blood-films was markedly abnormal. It is possible that some of the non-tuberculous cases may have been out of health in other respects. The fifth from the top has a definite leucocytosis and the sixth a very low Von Bonsdorff count. In the tuberculous series, the cases have been arranged from above downwards in order of their abnormality in respect to the relation of lymphocytes to monocytes, and it will be seen that, in this respect, all except one showed a marked increase in monocytes.

It is the writer's opinion that these simple methods of blood examination are of decided value in the assessment of progress in cases of tuberculosis, and taken together are capable of useful application in helping to establish a diagnosis.

———

THE MEDICAL SERVICES OF A DIVISION ON ACTIVE SERVICE.[1]

By Major-General H. ENSOR, C.B., C.M.G., C.B.E., D.S.O., K.H.S.

The following paper is entitled "The Medical Services of a Division on Active Service in Open Warfare." Position warfare, i.e., trench warfare, will not be touched upon.

It is practically certain that future wars will begin as open warfare, even if later they degenerate into position warfare. The medical services in position warfare are not of any great difficulty or interest. The duties of line of communication and base medical units will also not be considered, beyond mentioning those which form the link between the field medical units and the medical hospitals at the base. We shall also not consider the medical services of a cavalry division.

A division is a unit which can be described as a small complete army. It contains troops of all branches of the fighting services, except tanks and armoured cars. It consists of a Divisional Headquarters, a Royal Artillery Headquarters, Royal Engineer Headquarters and a R.A.S.C. Headquarters. The units are a cavalry regiment, 3 brigades of field artillery and a pack brigade, 3 field companies R.E., a field pack company R.E., divisional signals, 3 infantry brigades (12 battalions), a supply company, R.A.S.C., a baggage company R.A.S.C., 3 field ambulances, a field hygiene section and a provost company.

A division practically never acts alone. It is usually one of an army corps. The definition of an army corps, or corps as it usually is called, is a group of two or more divisions. The definition of an army is a group of two or more corps.

The chief duties of the medical services of a division are the following :—

(1) The collection and temporary treatment of the sick when conditions are normal, and of the wounded during battle.

(2) The supervision of the sanitation of units, whereby avoidable losses of officers and other ranks from disease may be reduced to a minimum.

The A.D.M.S. of a division, who is a substantive or temporary Colonel, controls the medical services and is responsible to the Divisional Commander and to the D.M.S. Army, that these duties are carried out. He is assisted by a D.A.D.M.S., who is usually a Major, and who, in addition to his duties, acts as medical officer in charge of Headquarters and sanitary officer to the division. The A.D.M.S. and his assistant are attached to the headquarters of the division, so that they may be in close touch with the Divisional Commander and his staff.

If he is not in close touch, he will not know what the intentions of the

---

[1] Read on December 8, 1930, before the United Services Section of the Royal Society of Medicine, and published by permission of the Society.

Divisional Commander are, and thus will not be able to make provision beforehand for the efficient carrying out of the medical services. His responsibility, in theory, ends when he has carried out the collection and temporary treatment of sick and wounded in the area occupied by the division, and ensured supervision of the sanitation. The evacuation of the sick and wounded from the divisional area is the responsibility of the D.M.S. of the army to which the division belongs. Sick and wounded are removed from the division by means of a medical unit called a motor ambulance convoy, which transports them to a casualty clearing station. The A.D.M.S. acts as O.C., R.A.M.C., of the division, and is responsible for the distribution of R.A.M.C. officers throughout the division. A R.A.M.C. officer, however, attached to a combatant unit, is not under his command except for technical matters. The O.C. unit is that officer's commanding officer. The A.D.M.S. can, however, if he sees fit, relieve any of these attached officers by others. In practice, he usually does this in direct communication with the O.C. unit concerned. To be absolutely correct, he should, if time allows, issue the necessary orders through the "A" branch of the staff.

He also, as O.C., R.A.M.C., issues orders for the R.A.M.C. units of the division. The most important of these orders are those known as Operation Orders which, when conditions permit, are issued by him before a battle. In these orders he definitely orders certain field ambulances to collect wounded in definite areas, and to form main and advanced dressing stations at sites selected by himself, and also states what unit or units will be in reserve, and where.

It is obvious that such orders can, so far as the advanced dressing stations are concerned, be only issued when the division is going to make a deliberate attack, or to stand on the defensive. In the event of an encounter battle, he can do little more than issue orders as to the site of the main dressing station and walking wounded collecting post. It is a general rule that only one main dressing station should be formed at first, and a minimum of advanced dressing stations opened. As large a reserve as possible must be kept.

It is equally obvious that the A.D.M.S. cannot issue operation orders to his medical units unless he knows fully the intention of the divisional commander. He is informed of this by means of divisional operation orders, issued by the staff, of which he gets a copy.

In good divisions he is informed of what he needs to know before the issue of the divisional operation orders, as this gives him more time to make his arrangements.

The R.A.M.C. operation orders must not be issued to the Os.C. field ambulances and field hygiene section before they have been approved by the "G" and "A" branches of the staff. Another warning is never to choose sites for advanced dressing stations from the map alone; they must be personally reconnoitred.

The supervision of the sanitation of a division is not a difficult matter. In war all R.A.M.C. officers are sanitary officers, and the O.C. field hygiene section and his staff carry out frequent sanitary inspections of the lines of the various units. The duties of an A.D.M.S. in this respect usually amount to the issue of instructions as to the segregation of contacts of infectious disease, etc.

The A.D.M.S. has no responsibility with regard to the bathing and laundry arrangements of a division. These are dealt with by the "Q" branch of the staff.

The medical services of a division are carried out by the following:—

(1) The regimental medical establishments.

(2) The field ambulances.

(3) The field hygiene section.

The Regimental Medical Establishments.

On active service a large unit such as an infantry battalion, etc., has attached to it an officer, R.A.M.C., who in action has under his orders the regimental stretcher bearers of the unit. In battle this officer forms a regimental aid post. To this post wounded are sent or brought, after they have received first aid from the regimental stretcher bearers.

The site of the regimental aid post is decided upon by the unit commander in consultation with his medical officer, and it is, as a rule, sited somewhere near the unit headquarters.

The responsibility for clearing wounded and sick brought to the regimental aid post is laid on that field ambulance commander who has been detailed by the A.D.M.S. to clear the area in which the unit is operating. Prisoners of war captured by the unit can be made use of for this purpose.

The officer in medical charge of a unit has other duties besides those he performs in action. He is the responsible adviser of his commanding officer in all matters connected with sanitation, and his C.O. is responsible that action is taken on all sanitary recommendations his medical officer may make. It cannot be too strongly impressed on all officers that the commanding officer of every unit is responsible for the sanitation of his unit, not his medical officer.

One of the medical officer's most important duties is to prevent sick wastage by every means in his power. No man is to be sent to a field ambulance as sick unless he is really sick and unfit to remain with his unit.

The officer in medical charge is provided with a very good medical and surgical equipment, and he indents on the nearest field ambulance for any articles he requires to complete his equipment.

The Field Ambulances.

These units are three in number and the present war establishment of a field ambulance is 11 officers and 215 other ranks; of this number 10

officers and 158 other ranks are R.A.M.C.; of the attached one is an officer of the Army Dental Corps and the great majority of the remainder belong to the R.A.S.C.

A field ambulance consists of headquarters and two companies, while its ambulance transport is made up of four heavy horsed ambulance wagons and six heavy six-wheeled motor ambulance cars.

The headquarters is designed to establish and staff a main dressing station, and each company to establish and staff an advanced dressing station. Very up-to-date equipment is provided for this purpose with adequate transport.

The stretcher bearers of the unit are divided between the two companies. This is necessary, as the rôle of a company is to form an advanced dressing station, and the stretcher bearers are required to clear the regimental aid posts of wounded and to bring them to the advanced dressing station.

The medical and surgical equipment of headquarters is carried in three 30-cwt. motor lorries, while that of the companies is still horse-drawn in six G.S. limbered wagons, three to each company. The horsed ambulance wagons belong to the companies and march with them (two to each company), while the six motor ambulance cars belong to the headquarters.

The field ambulances are divisional troops like the R.A., R.E. and R.A.S.C., and do not belong to the infantry brigades. They are allotted for duty with infantry brigades by the A.D.M.S. as he thinks necessary.

The field ambulances of the Expeditionary Force do not exist in peace time. They are formed on mobilization, as are all medical units of the Expeditionary Force.

This is a great disadvantage, as the officers and men of such units are at the beginning of a war unknown to each other for the most part. Our regular R.A.M.C. personnel in peace time get very little instruction in field ambulance duties, which are almost entirely different from those they perform in peace time. In this respect the R.A.M.C. of the Territorial Army have an advantage over us. This being the case, the commanding officer of a field ambulance should be an officer who has good experience in war; fortunately we have at present many such. It is not necessary that he should be a specially good surgeon, but he must be a good organizer and possess ample capacity of command. He must have an adequate knowledge of how infantry are handled in battle. It must be remembered that his unit has to work right up to the infantry in action, and he must be able to visualize what is going on in front of him.

A field ambulance should possess at least one officer who is above the average in operative surgery. He should be employed in action at the main dressing station, where such operations as are absolutely necessary to save life are carried out. No other operations should ever be performed in a field ambulance.

It is most important also that the unit should not be encumbered with

sick when it is on the line of march, and especially when contact with the enemy is expected. Only sick likely to be fit for full duty within twenty-four hours should be kept with a field ambulance; all others should be evacuated to a casualty clearing station. All sick received from units must be carefully inspected on arrival, and if any of them are considered to be fit for duty they should be returned to their units. Regimental medical officers must accept the opinion of the O.C. field ambulance as final in this respect.

A field ambulance commander may be called upon to form advanced and main dressing stations, a walking wounded collecting post and, under some circumstances, a divisional rest station.

Advanced Dressing Stations.

These will, in the case of a deliberate attack on the part of the division, or when a division is on the defensive, be sited normally by the A.D.M.S., the approval of the "A" and "G" branches of the staff having first been obtained. The personnel to be employed at each advanced dressing station will also be decided by him, i.e., whether one company or two will form the staff.

In the event of an encounter battle there will be no time for the leading field ambulance commanders to receive orders from the A.D.M.S. as to where the advanced dressing stations should be sited. They must be sited and opened by the field ambulance commanders themselves, and the map references sent at once by motor cyclist to the A.D.M.S. The site chosen should be one that is not under direct observation from the ground, should be on a good road and in good buildings when possible. It should have its own water supply, possess facilities for cooking, etc., have ample accommodation for cases, and should not contain a large quantity of inflammable material, such as hay and straw. During an action an advanced dressing station may expect to get a field gun shell or two in it, which will probably not do much harm. It will be a different matter if barns full of hay and straw are being used as wards for serious cases. When it can be arranged, one advanced dressing station should be large enough to be made into a main dressing station in the event of a rapid advance after a success over the enemy.

A farm off the main road often appears to be an ideal place for an advanced dressing station. Before deciding to use it for this purpose, examine the road leading to it from the main road. If it is metalled and broad enough for two cars to pass, and there is a turning space on the lee side of the building, well and good, utilize it as an advanced dressing station. If the road leading to it is merely a cart track and not metalled, do not use it unless you must. An advanced dressing station must be an advanced dressing station. In other words, it must be well forward, especially when the division is going to attack the enemy. When it is on the defensive it

is justifiable to site it a considerable distance in rear, so that an initial success on the part of the enemy does not render it at once untenable. It should, when an attack is about to be undertaken by the division, be sited somewhere in the zone between the firing line and the forward field artillery positions. The windows facing the enemy on that side of the buildings selected should be blocked by sandbags to a height sufficient to give protection against rifle bullets and shrapnel.

An advanced dressing station must display the Union Jack and the Red Cross flag in the prescribed manner by day and the distinguishing lights at night. They are displayed for the information of our own troops. It is simply asking for trouble to display them in such a way that they can be visible to the enemy from the ground. The duty of an officer in command of an advanced dressing station is to clear the regimental aid posts in the area for which he is responsible of all wounded collected at them, and to take them to the advanced dressing station. He does this by means of the bearers of his company assisted, when practicable, by his horsed ambulance wagons. If the regimental aid posts are more than 600 yards from the advanced dressing station, a bearer collecting post should be formed at a place about half-way between the aid posts and the advancd dressing station. It should be sited so as to serve two aid posts, and care should be taken that its position is not visible to the enemy on the ground. It must also, when practicable, be on a road capable of being used by horsed transport. To this bearer collecting post wounded are brought by the field ambulance bearers from the regimental aid posts, and from thence taken to the advanced dressing station by wheeled transport, if possible, or by a relay of bearers. An officer should always be in charge of a bearer collecting post, and provision must always be made for carrying out any treatment to cases which is absolutely necessary, and also for the feeding of the bearers. The bearers must not be allowed to become exhausted. Carrying heavy men on stretchers is very hard work. Clerical work at the advanced dressing stations must be reduced to a minimum. All that should be done is to make out the field medical cards and to record on them the nature of the injury and the amount of morphia given, if any. The injection of anti-tetanus serum is best carried out at the main dressing station. A record of the particulars of all cases brought in dead, or who die at the advanced dressing stations, must be kept.

The duty of keeping an advanced dressing station clear of wounded by evacuating the cases to the main dressing station is that of the O.C. field ambulance, if his ambulance cars are working under his command. If the A.D.M.S. has issued orders that a divisional motor ambulance convoy is to be formed, by pooling the ambulance cars of all three field ambulances, the officer appointed by the A.D.M.S. to command this convoy is responsible that he keeps all advanced dressing stations of the division clear of wounded.

Main Dressing Stations.

The main dressing station of a division, or stations, if there are two of them, should always be sited by the A.D.M.S. of the division and approved by the "A" branch of the staff. He can do this even in the event of an encounter battle. It must be large enough to accommodate large numbers of wounded in the event of any hitch occurring with regard to the evacuation of wounded from it to the casualty clearing station by the motor ambulance convoy which works under the orders of the D.M.S. Army.

Large modern schools make excellent sites for main dressing stations. If possible, the site chosen should be one that is suitable for a casualty clearing station in the event of a big advance taking place as the result of a victory.

The staff of a main dressing station should normally consist of the headquarters of a field ambulance, supplemented by any other troops available. The R.A.M.C. personnel of the headquarters cannot be employed in unloading ambulance wagons arriving at the main dressing station. They have other and more important work to do, as they are all "specialists." The War Establishments make no provision in a field ambulance for this work which has, however, got to be done. The "A" branch of the divisional staff should be applied to for personnel for this purpose, but it is not at all likely that help will be available from this quarter. The O.C. field ambulance should keep all slight cases able to do this duty without prejudice to their health, and the A.D.M.S. should issue orders that while the division is in action the personnel of the hygiene section shall also be employed. Their normal duties of sanitary inspection, etc., cannot be carried out when the division is in action.

A main dressing station must be carefully organized. It must possess a reception room for patients coming in, and in this room the clerical staff should take down the "particulars" of all cases for recording later in the Admission and Discharge books of the unit. A good dressing room with a good light is a necessity, and in this room operations absolutely necessary to save life should be performed, and all wounded injected with anti-tetanus serum. It should not be necessary to re-dress very many of the cases, if the work at the advanced dressing stations is going on satisfactorily. A mortuary is an unfortunate necessity, and some place should always be set aside for this purpose. It is unnecessary perhaps to say that a good kitchen is required, and also quarters for the R.A.M.C. personnel.

One of the most important of the many items of organization is to make adequate arrangements whereby motor ambulance cars bringing wounded from the advanced dressing stations can be given stretchers, blankets, and splints to replace those removed with the wounded. If this is not done, after a comparatively short time the main dressing station will be in possession of most of the stretchers of the field ambulances with the worst result, so far as the medical arrangements are concerned.

One of the weak points about the equipment of a field ambulance is the absence of an adequate number of stretchers and blankets to enable this exchange of such articles to be made. This difficulty is realized, and in war it is the duty of the D.M.S. Army to provide the extra equipment. He may not be able to get it, however, at the beginning of a war at any rate. Also, although it is easy to provide extra stretchers, etc., to field ambulances in position warfare, it will not be at all easy to supply such equipment in mobile open warfare when it is required. The field ambulances should always be in possession of reserve stretchers and blankets and have transport in which to carry them.

The Walking Wounded Collecting Station.

It is my opinion, if I may venture to say so, that our ideas and the R.A.M.C. training require to be changed with regard to this station.

Owing to improvements in fire weapons a division now attacks on a very much wider front than formerly, and is also capable of defending a very long line, ten miles or so. If you establish a walking wounded collecting station and expect slight cases after being dressed at the regimental aid posts to walk to it, and to find it, you will be mistaken, at any rate in the cases of those wounded on the flanks of the divisional front. They may be told where the collecting station is, and may set off with every intention of finding it, but most of them will inevitably get lost. At the same time some place should be provided for the collection and treatment of slight cases. You do not want them at the main dressing station, which should be reserved for dangerous and serious cases.

My own idea is that a walking wounded collecting station should be established in some suitable site on the main line of evacuation from the advanced to the main dressing station, near to, but some distance in front of, the main dressing station. All cases, both serious and slight, should pass through the advanced dressing stations and be evacuated by motor transport. A great number of slight cases can be evacuated by means of motor ambulance cars carrying serious cases to the main dressing station. As these cars pass near the walking wounded collecting station, they can stop and put down the slight cases, who can be shown the collecting station and told to walk there. It should also be possible to form a collecting post for walking wounded on roads leading from the advanced dressing stations to the main road of evacuation to the main dressing station. At these collecting posts motor lorries should be waiting to receive the walking cases, and when they are full to proceed to the walking wounded collecting station. The three 30-cwt. lorries of the field ambulance detailed to form a main dressing station could be utilized for this purpose. The advantage of having the collecting station near the main dressing station is that cases with little or nothing the matter with them can be picked out and sent to the main dressing station to help in unloading ambulance cars. The staff required for the walking wounded collecting

station should seldom exceed an officer, two N.C.O.'s, four privates for nursing duties, two clerks and a cook. The place must be organized on the same lines as a main dressing station. Particulars of all cases must be taken and anti-tetanus serum administered, and the fact recorded on the field medical cards. The evacuation of slight cases to the casualty clearing station destined to receive them is carried out by cars of a motor ambulance convoy or by special transport provided by the "Q" branch of the Corps Staff.

A Divisional Rest Station.

This station is only established when the division is at rest and not likely to move for some considerable time. It is designed for the care and treatment of slight cases of illness likely to be fit for duty in three or four days and thus obviate the necessity of sending them to the lines of communication.

Good accommodation is required and arrangements to give the patients a liberal diet and, as far as possible, recreation. One of the field ambulances should be detailed to form a divisional rest station.

The Field Hygiene Section.

This is a small but extremely useful medical unit. It is normally commanded by an officer, R.A.M.C., but the C.O. need not necessarily be a medical man. Its duties are the following:—

(1) Inspection of the sanitation of units by R.A.M.C. N.C.O.'s specially trained in this duty.

(2) Making sanitary conveniences and giving instruction to selected personnel from units in the construction of such articles.

(3) Disinfection of billets.

(4) Sterilization of infected and verminous clothing.

It is obvious that the field hygiene section will not be able to carry out many of its functions when the division is on the march or when it is in action.

Its duties will be most important when the division is halted for a few days.

When the division is in action the bulk of the personnel should be detailed to assist at the main dressing station of the unit.

———

SALIVA-BORNE DISEASE CONTROL: ERADICATION.[1]

By JAMES G. CUMMING, M.D.

Dr. P.H., Chief, Bureau of Preventable Diseases, District Health Department, Washington, D.C.

THE following epidemiological research is valuable to the military service because it deals with the saliva-borne infections. These caused the highest disease mortality in the World War, and will be equally devastating in the next if adequate control measures are not instituted.

There will first be discussed, as a background for the research here reported, four epidemiological factors which determine infectious disease prevalence. These are: first, transmission rate; second, healthy carrier rate; third, susceptibility rate; and fourth, the degree of contact. The field observations, the laboratory and statistical research presented here are based on these factors. To the conclusions drawn from this work there will then be applied the three control factors leading to eradication: continuity of control, percentage of transmission blocked, and the evaluation of the various avenues of distribution.

THE TRANSMISSION RATE.

During the World War there prevailed the greatest facility of transmission for the saliva-borne diseases. At that time our knowledge of the relative importance of the avenues of distribution was limited. Control was attempted chiefly through blocking air-borne, or direct contact, transmission; it was not until the 1918 influenza-pneumonia epidemic that the importance of indirect transmission was recognized and adequate control measures for blocking such transmission devised. In brief, stoppage of distribution had been attempted through blocking the minor avenue only; while the major avenues, those of indirect contact, were unrecognized and uncontrolled.

The necessity of identifying the route, or routes, of transmission is shown in the history of all communicable diseases which have been brought under control. For example, the research of Reed and his colleagues led to the control of yellow fever; the investigations of Vaughan added much to our knowledge of typhoid control. Through such research it was made possible during the late war, to block transmission for both the insect and the intestinal-borne groups of infections. All this research dealt with transmission; as the result we had mosquito and louse control, sanitary supervision of food and water supplies, sewage disposal—all blocking

---

[1] Honourable mention, Wellcome Prize Research Report, 1929. Reprinted by permission from *The Military Surgeon*, vol. lxvii, No. 4, October, 1930.

distribution. In short, the transmission rate is the prime factor; its successful application relegates all other factors to the background.

The Healthy Carrier Rate.

For the saliva-borne infections there is a high percentage of carriers[1] among the civil population. Previous to the war the chief avenues of dissemination had not been demonstrated and no successful effort had been made in control; the result was a high healthy carrier rate among the citizenry entering the Army.

With these recruits as a starting point, and in the absence of measures for blocking the major avenues, the Army carrier rate increased with each succeeding month. This increased prevalence of carriers in the enlarged Army is accounted for, not only because there were carriers among recruits as primary sources of infection, but, even more, because those primary sources of transmission were not blocked, which resulted in an accumulative increase of carriers as time passed.

In contrast with this situation in the saliva-borne group of diseases, the healthy typhoid carrier rate in the World War was greatly reduced over that for the Spanish-American War. This reduction resulted from blocking the major avenues—water and milk—of typhoid distribution in cities during a period of about ten years prior to the late war. While this reduction of carriers in civil communities was a favourable influence, it is to be pointed out that typhoid carriers could play but a negligible part in distributing their disease in the Army at that time, because there, as well as in civil life, the major avenues had been for years continuously blocked.

It is, then, not so much the prevalence of carriers, but rather success in blocking the chief routes of transmission, which determines the prevalence of disease. Indeed, in the absence of control of transmission, even a few carriers may provide primary sources for veritable epidemics.

Susceptibility Rate.

A considerable percentage of recruits had no acquired immunity to either the virus or other infections; they had not been previously exposed. Unavoidably susceptibles poured into the enlarging army. It was impractical to segregate these from the non-susceptibles; therefore the problem of control of communicable disease had to be attacked from the standpoint of protecting susceptibles.

The susceptibility rate is a minor factor; it becomes important in the protection of troops only when the avenues of spread are wide open. Then the disease runs its course, and a resultant shortage of susceptibles terminates the epidemic. That occurred in the 1918 influenza-pneumonia epidemic; the result was an immunized Army, but at an overwhelming cost.

---

[1] Carriers, as used in this paper, include not only healthy carriers, but also mild unrecognized cases and convalescents.

The Army was protected against the insect and intestinal-borne diseases. Had effective measures for the control of transmission of saliva-borne infections been in operation, susceptibility, which is a minor epidemiological factor, would have played little part in the prevalence of influenza-pneumonia.

Crowding or High Numerical Contact.

Massing of troops in training, in manœuvres, and in battle is essential to military success. This unusual crowding of men, however, facilitates disease transmission only when the routes of distribution are not blocked. During the Civil War the Northern troops were massed in the Tidewater district of Virginia before the attack on Richmond and malaria prevailed to such an extent that the Army was almost incapacitated. In the late war troops were massed in that same general area, yet there was only an insignificant amount of malaria. In the Spanish-American War troops were crowded in camps, and typhoid fever was most devastating; in the World War there was massing with only an occasional typhoid case. The avenues of malaria and typhoid transmission were blocked, thus relegating to the background the factors of massing, susceptibility and carriers.

The operation of the four epidemiological factors, after having had full sway for centuries, can now be so curbed as to circumvent their devastating results. As has been pointed out, among these is one—a prime factor—which, when under control, counterbalances the unfavourable influences of the other three. This is the transmission rate. Block the major avenues of transmission, automatically the healthy carrier is eliminated as a source of infection; the susceptible is protected against the disease; even high numerical mass contact is rendered negligible.

In brief, successful control of disease dissemination through closing the major avenues of transmission is the key which locks the door against invasion by the other three factors.

Civic Co-operation.

This control of the transmission rate had been in operation against the insect and intestinal-borne diseases in civil communities for ten years or more before the war. It had, through these years of effort, greatly reduced the number of healthy carriers of these two groups of diseases; through this control there had come about a gradual reduction in transmission, resulting in fewer and fewer cases as time passed. Such cumulative reduction in cases and sources lead, inevitably, to a cumulative reduction in carriers. That reduced carrier rate benefited the Army, by reducing sources of malaria and typhoid among recruits.

While this lower carrier rate among the incoming groups was important, of greater importance was the fact that this scientific knowledge of control was applied in the Army where disease hazards were so augmented. As a result, the occurrence of these two diseases, as well as of the dysenteries, was insignificant. This chain of events made it possible,

in so far as these two groups of disease were concerned, to recruit a healthy Army, to maintain its health, and to return healthy men to their communities.

It is apparent, then, that the citizenry has a responsibility for the health of its Army, but there is a vast difference between mass protection in typhoid and small group sanitation and individual hygiene as control measures for the saliva-borne diseases. The first is administrative and regulated by law; the second largely a matter of small group practices and individual habits; in one there is centralized, and in the other personal, responsibility.

As the typhoid mortality of a city is now an index of the purity of its water and milk supplies, so the influenza-pneumonia mortality of a community will become an index of its group sanitation and personal hygiene.

Research.

The conclusions from the following field observations, and from the statistical and laboratory research here presented will enable, not only the Army, but the communities as well, to control more effectively the saliva-borne diseases. As has been pointed out, the health of a nation influences the health of its Army.

Indirect Contact Transmission.

Mess Kits.

It is believed that our original theory of mess-kit transmission extended to include group sanitation and personal hygiene, supported by statistical studies and confirmed by laboratory research, will enable the military service, in co-operation with the citizenry, to relegate the saliva-borne diseases to the innocuous status now held by the once devastating typhoid and malaria.

In order to check on the transmissibility of influenza-pneumonia through mess-kit wash-water it became necessary to compare the influenza rates of groups using mess kits with those eating from tableware. There was high numerical indirect contact—crowd transmission—among those using mess kits; their hands, as well as their mess gear, became contaminated with the mess-kit wash-water which contained in suspension the mouth organisms of the group. On the contrary, in those groups using tableware, hand contamination by mess-kit wash-water did not occur, for here the dishes were washed collectively in the kitchen.

Our first statistical study, in conjunction with a careful field survey, was made at eleven different camps or posts during the early part of the influenza epidemic; a record of each organization composing these camps was made on the basis of the method of messing. Thus there were two groups, one of which used tableware or mess kits which were boiled, the other ate from mess kits which were washed by the old line method.

At the close of the epidemic a request was made through the commanding officer of each camp for a report of the incidence of influenza

by organizations under his command. The data thus collected were sorted and allotted to the particular group—either the collective or the individual dish-washing group. The rate of infection per 1,000 troops was then determined.

In this epidemiological study there were 66,076 troops; among 33,452 there was collective washing of utensils: while among 32,624 there was individual washing of mess kits: [1] The sick rate from influenza in the former group was 51·1 per 1,000 troops; while in the later it was 252 per 1,000. Thus the facility of transmission by mess-kit wash-water through high numerical indirect contact was substantiated by statistical data. There were five times more influenza cases among men exposed to mess-kit wash-water transmission than among those who ate from the collectively washed tableware.

A second field observation on the methods of washing mess kits, as such methods might influence disease and death-rates, was made at a camp composed of 5,971 men. [2] This survey extended over a period of ten months. The camp was studied in two groups, one of 3,115 men was protected through the use of mess-kit wash-water which was kept over a fire; whereas the other group of 2,856 men was not protected by such means; they used the customary lukewarm wash-water.

In the protected group the water was not always boiling, but its temperature ranged from 76° C. to 100° C., so hot that the men could not use their hands as dish mops. In contrast, the unprotected group washed their mess kits in pans of water which were placed on the ground. The temperature of this water ranged from 38° C. to 50° C., only lukewarm and bearable to the hand.

The observation at this camp was unusual in that both groups used mess kits; yet in one there was protection against high numerical indirect contact transmission; the hand-to-mouth and mess kit-to-mouth distribution of organisms was blocked by the boiling, or nearly boiling, water. There was here a difference in the group sanitation; there should, then, be a difference in their protection against saliva-borne disease transmission which would influence the disease and mortality-rates.

The ratio of cases during the ten months' period in the protected and in the unprotected groups was: For meningitis, 1 to 28; diphtheria, 1 to 2; mumps, 1 to 8; measles, 1 to 17; influenza, 1 to 4; and pneumonia, 1 to 8. In the protected group there were only 259 cases of saliva-borne diseases; while in the unprotected group there were 2,624. This gives an annual rate per 1,000 troops of 177 for the protected and of 1,110 for the unprotected—a ratio of 1 to 6·2. Eighty-five per cent of the cases occurred in the unprotected group.

During the period of the investigation ninety-four per cent of all deaths from saliva-borne infections were either primary or secondary pneumonias In the protected group there were fourteen pneumonia deaths, but in the unprotected there were eighty-six. There was an annual rate per 1,000

troops of 5·1 for the protected against 36 for the unprotected, a ratio of 1 to 7. Eighty-eight per cent of the camp mortality occurred in the unprotected group.

The Five-link Chain.

It has already been indicated that the higher case and mortality-rates in the unprotected units were due to mass indirect contact, to susceptibility, to carriers—especially those of the pneumonia-producing organisms—and, finally, to facility of transmission through warm mess-kit wash-water.

Such transmission may be diagrammed by the following five-link chain of distribution:—

1	2	3	4	5
Oral cavity of carrier	Hands Mess kit	Mess-kit wash-water	Hands Mess kit	Oral cavity of susceptible

The oral cavity, the first link, is the reservoir of the virus infections, in mild unrecognized cases and convalescents, as well as in acute and chronic carriers of potentially dangerous organisms, including streptococci. Organisms found in the oral cavity of any individual are also generally found on his hands and on his eating utensils [3].

Thus the hands and mess kit constitute the second link, a double one, both in fact and in the amount of contagion transmission. The lukewarm mess-kit wash-water, the third link, was the central focus of distribution by indirect mass contact for all the men. The hands and mess kits of susceptibles—constituting the fourth link—passed on, as will be shown, the contamination of the mess-kit wash-water to the oral cavity—the portal of entry of the saliva-borne diseases.

Confirmation by Laboratory Research.

In order to connect these five links of contagion distribution through mess-kit wash-water, it became necessary to demonstrate that connection by the use of a nonpathogenic organism: *B. prodigiosus* [4]. In this series of experiments there were three groups of ten men each. Five men in each group served as donors (carriers). Their mouths were sprayed before each of six consecutive meals with a suspension of *B. prodigiosus*. These five men washed their mess gear in one gallon of warm water, after which the five recipients (susceptibles) washed their mess gear in the same water.

It will be noted that here the six successive meals simulated the multiple indirect contact of field conditions. In the field there was at each meal, multiple indirect contact, and this contact was repeated thrice daily.

The bacteriological test for *B. prodigiosus* in the separate links of the five-link route of transmission is summarized in the table on the following page.

The joining of the five-link chain of multiple indirect contact was established by this laboratory research. Further, these experimental results, in conjunction with statistical research on influenza-pneumonia as influenced by eating-utensil sanitation, confirmed our previously advanced

```
                 Donors                       Recipients
Links : 1          2            3                 4             5
                 Hands                          Hands
              33 per cent                    45 per cent
               /        \                     /        \
Oral cavity  /            \     Mess-kit    /            \  Oral cavity
53 per cent  \            /    wash-water   \            /  34 per cent
               \        /      66 per cent    \        /
              Mess kits                      Mess kits
              16 per cent                    72 per cent
```

theory of contagion distribution through warm mess-kit water. These results stress the importance of group sanitation as influenced by the use of boiling mess-kit wash-water as a means of maintaining a high standard of crowd sanitation.

Nichols worked with the antiseptic action of soap in dish-water as a barrier against saliva-borne disease distribution [5]. As he and others demonstrated, certain soaps, especially sodium oleate and resinate in clear-water solution of pH 8·5 at room temperature, readily kill pneumococci and streptococci. He likewise shows that if the reaction of soap solution is changed from pH 8·5 to 7 by acids, the antiseptic action is lost, and states further that there is apparently enough acid in some dirty dish-water to change the reaction and to destroy the antiseptic action of the soap. He cites an example in which a soap solution of pH 8·7 was used for washing mess kits. After the washing process the pH reading was 5·8 and there was no antiseptic action on *B. influenzæ*, pneumococci, streptococci or on staphylococci.

Weaver concluded from his research that foreign substances interfere markedly with the germicidal activity of soap [6].

During the war large numbers of mess kits or dishes were washed in the same water. There was the resultant addition of food particles, grease, organic acids and salts, all of which not only tend to neutralize the cleansing effect of soap, but, as stated by Nichols, these also destroy the germicidal action.

Tableware Transmission.

The investigation of the distribution of the saliva-borne infections through mess-kit wash-water was extended to the civil communities to include the transmission of these diseases by tableware.

If practical means could be devised for reducing the number of cases, and hence the number of sources of infection in the civil population, such reduction would be a great aid to the army—there would be less extra-cantonment or post-distribution filtering into the Service through recruits. But, as already shown, cases and carriers, as sources of infection, can be reduced only by a reduction in the transmission rate.

As has been established, mess-kit wash-water was the common focus of saliva-borne disease distribution through contaminated hands and mess gear. Was there not, then, a similar mode of indirect distribution through tableware among the general population? The oral cavity is the reservoir for distribution of the saliva-borne diseases; at the same time it is the entrance portal for this group of infections; of all inanimate objects eating utensils come most frequently in contact with the oral cavity and there pick up infection and, if not sterilized, eating utensils pass on that infection to the next user. In the small family gatherings tableware disease distribution is limited to the family; in public eating places the dissemination is in proportion to the size of the group.

Immediately following the influenza-pneumonia epidemic a field investigation was made in two large cities of the influenza rate as affected by the methods of washing dishes [7]. It was our observation that by the machine-washing methods, the water was either very hot or boiling; on the contrary, by the hand methods, the average temperature was only 44·5° C., a temperature which has no sterilization effect on bacteria. Later it will be shown that hand dish washing removes but 78 per cent. of the bacteria; whereas machine washing removes 99·17 per cent.

This survey included 21,411 men and women employed in hotels, restaurants, and in department stores where meals were provided for employees. There were 17,236 who ate from machine-washed dishes, among whom there was a case-rate of 20 per 1,000. There were 4,175 who ate from hand-washed dishes, and among those unprotected persons there was a rate of 103 per 1,000. Machine washing of dishes provided a high standard of group sanitation, minimized mass indirect contact, and, in addition, gave an eighty per cent protection against influenza infection.

A second survey was made on the method of washing tableware as this might influence the influenza rates in public institutions, Federal and State, with a population of 252,186 [8]. In establishments using machine-washed dishes there were 84,748 inmates. Among these there was a case-rate of 108·9 per 1,000. In the institutions using hand-washed dishes there were 167,438 inmates; among these unprotected individuals there was a rate of 324·8 per 1,000. In the protected groups the mortality-rate was 10·4 per 1,000; whereas in the unprotected it was 23 per 1,000.

It will be noted that the chance of influenza infection was three times more, and the chance of dying two times greater, in the unprotected than in the protected groups. Hence it is obvious that in such institutions eating-utensil distribution of influenza is responsible, either directly or indirectly, for a majority of the transmissions and therefore of cases and deaths.

Confirmatory Research.

Our contention that organisms of the saliva-borne infections are in the oral cavity, and that they may be transferred by indirect contact by eating

utensils, is further confirmed by the following laboratory research on tuberculosis, as well as by that on *B. prodigiosus* already quoted.

Spoons were used as the transferring agent, and guinea-pigs as the test animals to determine the presence or absence of tubercle bacilli [9]. After the spoons were used by open cases of tuberculosis they were washed singly or in pairs, and the wash-water injected into guinea-pigs. Among thirty-one such tests eleven, or thirty-five per cent, of the guinea-pigs died from tuberculosis. These experiments indicate the frequency in open cases of oral-cavity contamination by tubercle bacilli.

In the next series of tests the spoons used by open cases were first hand-washed in hot water by a nurse in the ward. They were then taken to the laboratory, placed singly or in pairs, in large-mouthed bottles, containing fifty cubic centimetres of warm water, and shaken for five minutes. This rinse water was centrifugated and the centrifugate injected into guinea-pigs Among thirty-six such tests nine, or twenty-five per cent, of the guinea-pigs died from tuberculosis. The results of this series of tests indicate the frequency with which tubercle bacilli may be transferred by tableware from the open case to members of the same messing group, who are exposed to this multiple indirect-contact transmission thrice daily as long as the tableware is not sterilized.[1]

Prior to our original report in 1919 on table utensils as a vehicle of tubercle-bacilli distribution, only 1·5 per cent of the pamphlets publishing advice to consumptives referred to tableware sanitation. A review, however, four years later, of such publications disclosed that all advised either the use of separate dishes, or that tableware be boiled. The adoption of that advice will do much in blocking eating-utensil distribution of tuberculosis, one of the major avenues of transmission. The military service will benefit by this reduction in transmission among the civil population; there will be fewer beds in army hospitals occupied by consumptives and fewer claims paid tuberculous ex-service men.

Floyd and Frothingham confirm our research on tuberculosis transmission in their report on "Table Utensils as Sources of Tuberculosis Infection" [10]. These workers agree with our theory when they state that, "The belief is constantly growing that tuberculosis and probably all of the so-called air-borne diseases are, in the majority of cases, hand-to-mouth, or ingestion infections."

In their series of investigations they report that twenty-one per cent of the guinea-pigs died from tuberculosis when injected with the wash-water of table utensils used by tuberculous patients, and that two per cent of the animals died when injected with the moppings of washed dishes.

Among their conclusions they make the following statement: "The table utensils used by open cases may harbour tubercle bacilli even after more careful washing than is customary in the average home."

[1] In this connection, attention is invited to Chapters viii to xi of "Tubercle Bacillus Infection, and Tuberculosis in Man and Animals," by Albert Calmette.

Taylor reported in detail results of research in three public sanatoria where the dishes were either machine washed or hand washed with soap powder and hot water, and concludes that: "Public health officials should enforce the necessary use of steam or hot water in hotels, restaurants, and soda fountains [11]. These public eating places must to a certain degree be responsible for the dissemination of all the infectious diseases of the air passages and lungs."

Hand and Machine Dish-washing Methods.

That public eating places and the home may be foci of distribution for the saliva-borne infections—due to a low standard of eating utensil sanitation—is indicated by the following research [12].

The average temperature of seventy-two specimens of hand-washing dish-water was but 44·5° C., and the average bacterial count 6,792,500 per cubic centimetre. In contrast to this low temperature which has no sterilizing effect on bacteria, the average temperature of fifty-five specimens of machine-washing dish-water was 91° C., and the bacterial count was but 960 per cubic centimetre. The use of water which was at or near the boiling point, reduced the number of bacteria 99·98 per cent—a reduction comparable to that secured by the purification of our public water supplies in the control of water-borne diseases.

Is there a reduction in the number of bacteria adhering to machine-washed utensils over that of hand-washed corresponding to the reduction in the dish-water counts for the two methods of washing? The average bacterial count of 950 unwashed spoons was 674,500 per spoon. The count for 1,000 spoons after they had been hand washed was 154,000 bacteria per spoon. By this method of dish-washing, then, only 78·82 per cent of the organisms were removed. In contrast, 750 spoons washed by the machine method had an average bacterial count of but 4,790 bacteria per spoon, a removal of 99·17 per cent per spoon.

Dearstyne supports our theory when he states that "Carelessly washed dishes are potential disseminators of infection," and he concludes from relative bacterial counts between machine- and hand-washed utensils that "It is certain that in most restaurants and other public places too little attention is paid to the washing of dishes" [13].

Pathogenic organisms can readily be identified in water used to wash utensils which have been used by patients or by healthy carriers [14]. In the bacteriological examination of thirty-two specimens of wash-water, the *Streptococcus hæmolyticus* was isolated from eighty-four per cent of the specimens. In sixteen specimens pneumococci were isolated from sixty-three per cent; in thirty-two specimens *S. viridans* was isolated from sixty-five per cent; and in thirty-one specimens the *B. tuberculosis* was demonstrated in thirty-five per cent of the specimens.

Tableware transmission is a three-link chain; the first link is the oral cavity of the infected person; the second, the tableware, and the third

link is the oral cavity of the susceptible person. The first and third links are moist — a condition which facilitates transfer to and from the intermediate second link.

In brief, in public eating places, as well as in the home, the method of washing dishes by hand without the use of boiling water, results in a high numerical, or mass indirect contact, distribution of the saliva-borne infections. On the other hand, in either the mechanical or hand-washing method, the use of water at, or near, the boiling point, closes this major avenue of indirect transmission of the saliva-borne infections.

Hand Transmission.

The hands of healthy carriers have long been recognized as the transmitting agent of the intestinal-borne diseases. If the hands become contaminated with the intestinal organisms, there is a far greater chance of hand contamination with the saliva-borne infections.

In order to determine the frequency of hand contamination the hands of cases and carriers were examined for pathogenic organisms [15]. In 340 such examinations the *S. hæmolyticus* was isolated in 38 per cent. In 41 tests pneumococci were found in 17 per cent. In 8 the *S. viridans* was isolated in 100 per cent, and in 7 the *B. tuberculosis* was found in 43 per cent. These tests indicate the frequency with which hand contamination occurs among cases and carriers.

Inanimate Objects as Conveyors of Transmission.

From the foregoing research it is concluded that the hands of recognized and of unrecognized cases, convalescents, and of healthy carriers, are contaminated with pathogenic organisms. The hands of these infected persons come in contact with innumerable inanimate objects which are handled by susceptibles. In order to substantiate our theory of indirect contact transmission, the following research was undertaken to ascertain to what extent inanimate objects were contaminated.

The bacteriological investigation of such objects included bedside table-tops, bed posts, door knobs, and the handles of sputum cups [15A]. In sixty-one examinations the *S. hæmolyticus* was found in 13 per cent; in fourteen pneumococci were found in 50 per cent; and in forty-five *S. viridans* was found in 26 per cent.

Not only does the contaminated hand deposit organisms on these inanimate objects, but these organisms may be conveyed to other hands. That this actually takes place is shown by the fact that, in these experiments, the gloved hand was wiped over the test object and the contamination adhering to the glove was transferred to the culture media.

This transmission of contamination by inanimate objects forms a five-link chain. The donors of infection are cases—both recognized and unrecognized—convalescents, and healthy carriers. In this group the nose and oral cavity constitute the first link in the chain; their hands the

second, and inanimate objects which they handle the third link; fourth link, hands of the susceptibles who handle these contaminated inanimate objects; while the nose and oral cavity of the susceptibles constitute the fifth link. From the laboratory research here summarized these five links have been definitely connected, so that there is an unbroken chain of indirect transmission of infection from donor to recipient.

The importance of this avenue is apparent when there is massing or crowding, involving high numerical indirect contact as in the army. The larger the group, and the lower their standard of personal hygiene, the greater will be the multiple indirect contact through this five-link chain of distribution; whereas in a similarly large group a high standard of personal hygiene protects against this major avenue of transmission.

The Pneumonia-producing Group of Organisms.

In the army during 1918, of the total number of deaths from infectious disease, approximately ninety-two per cent were due to pneumonia. Evidently, then, efforts must be directed continuously against the transmission of the pneumonia-producing organisms in order to reduce the healthy pneumonia carrier index in the civil community—the source of the army. Type pneumococci are one of the chief causes of mortality as a primary cause of death. During epidemic periods of the virus infections, especially measles, influenza, smallpox and typhus fever, streptococci are responsible for high mortality. Then, as secondary invaders, streptococci are the immediate cause of death.

Our original research on measles mortality brought out two important points relative to the prevention of measles-pneumonia mortality in the army: first, measles was not the cause of death; but rather the complicating involvements, pneumonia, pericarditis, empyema, septicæmia—the pneumonia group of organisms—were the cause of death; second, that those who developed pneumonia were healthy carriers of the pneumonia-producing group of organisms on entering the hospital.

We reported the bacteriological findings on thirty-one necropsies, eighteen of which were on patients dead from measles-pneumonia [16]. In these eighteen pneumonia necropsies hæmolytic streptococci were isolated in pure culture, or co-existently with pneumococci, with great regularity from the lungs, pleural and pericardial exudates, and from the heart's blood.

In protecting the army from the saliva-borne infections the fact is of basic importance that measles patients who developed pneumonia did not acquire this infection in the hospital; they were healthy carriers of the pneumonia-producing organisms on entrance to the hospital [17].

Throat-swab cultures were taken from 452 measles patients on entering the hospital. In this series of cases it was established that thirty-five per cent of the measles patients were healthy carriers of the *S. hæmolyticus* on entrance to the hospital, and that a third of these developed pneumonia;

on the other hand, of the sixty-five per cent of patients who were non-carriers of *S. hæmolyticus* only six per cent developed this complication.

It was evident from our laboratory studies that there were three divisions of patients. First, the non-carriers of *S. hæmolyticus* in whom there was but a remote possibility of type pneumonia ; second, the light carriers of *S. hæmolyticus*, in whom pneumonia might, or might not, develop with an excellent chance of recovery; and third, the heavy carriers in whom pneumonia would inevitably appear and terminate fatally.

Pneumonia as a complication of influenza is now so well understood that no comment is here necessary, except, for the purposes of this paper, to reiterate that it is not the influenza virus, but the pneumonia-producing group of organisms which are the immediate cause of death. Furthermore, in influenza, as in measles, the pneumonia complication is the result of the healthy carrier state.

In our investigation of an epidemic of hæmorrhagic smallpox there were twenty patients, eight of whom were, on admission to the hospital, tonsillar carriers of hæmolytic streptococci [18]. In this group of twenty patients death occurred among *S. hæmolyticus* carriers only ; six of the eight carriers died. The two who recovered were light carriers ; whereas, among those who died, there was an abundance of streptococci in the throat cultures. In all the fatal cases *S. hæmolyticus* was isolated, not only from the throat, but also from the blood-stream or from the heart's blood, or from both sources.

We found further incriminating evidence against the healthy carrier of the pneumonia group of organisms in a Russian command of 6,000 men among whom there occurred 245 typhus cases, 49 of which were fatal [19]. In eighty-two per cent of the autopsies there was a well-defined broncho-pneumonia, streptococcal in character. Thus in typhus, as in measles, influenza and smallpox, there was demonstrated a virus infection, as the contributing cause, with pneumonia as the immediate cause of death.

Obviously then, it becomes essential to prevent the healthy pneumonia carrier state in the army, and in its tributary, civil life.

The Susceptibility of the Healthy Pneumonia Carrier to Virus Infections.

A reduction in the healthy pneumonia carrier rate signifies more than a corresponding reduction in deaths. Statistical studies of measles and influenza indicated that the pneumonia carrier is more susceptible than the non-carrier to these virus infections.

Our first observation was on measles [20]. Here it was found that while these patients on entering the hospital had a thirty-five per cent *S. hæmolyticus* carrier rate, troops in the field had only a six per cent carrier rate. If the carriers and non-carriers were equally susceptible the ratio would then be the same for entering the hospital and for those in the

field. On the contrary, the carrier, in his potentially dangerous state is seven times more susceptible than the non-carrier to measles virus.

A further proof of this susceptibility of the healthy carrier to the virus infections was drawn from public institutions. A comparison was made of the case-fatality rates between groups protected against transmission and others not so protected [21]. If the carriers and non-carriers were equally susceptible to influenza, the ratio of influenza cases and the ratio of mortality from pneumonia per 1,000 inmates for the two groups would be the same. On the contrary, while the ratio for influenza in the protected and in the unprotected groups was 1 to 3, the ratio of pneumonia deaths per 1,000 in these two groups was 1 to 2·2. In other words the case fatality rate among the protected was 94·2; whereas among those not protected it was only 70·4. These rates show that there was a larger proportion of pneumonia carriers to non-carriers infected with influenza in the protected than in the unprotected group. Among the protected the restricted distribution of influenza limited infection chiefly to carriers, due to their high susceptibility. In the unprotected groups the facility of distribution resulted in influenza infection, not only in carriers, but spreading among the less susceptible non-carriers. Hence there were more influenza cases among the unprotected, but as it is the carrier who develops fatal complications, this group had a lower case-fatality rate.

A third statistical survey was made on the pneumococcus carrier susceptibility factor as it affected the influenza-pneumonia case-fatality rate in our army at home in 1918. The rates for several periods of the 1918 epidemic as compiled from the 1919 Annual Report of the Surgeon General of the Army are as follows :—

September and October	54 deaths per 1,000 influenza cases
November	23 ,, ,, ,, ,,
December	14 ,, ,, ,, ,,

Here again it can be pointed out that influenza does not kill, but that pneumonia does. The high case-fatality rate for the first period, and the decreasing rates for the succeeding periods of the epidemic are indicative of the greater susceptibility of the pneumonia carrier than of the non-carrier to influenza virus. On the basis of the rates here presented, the healthy carrier appears to be at least four times more susceptible than the non-carrier or than the light carrier.

An epidemic comes to a close because there is a lack of susceptibles; furthermore, it is evident that among those attacked the ratio of carriers to non-carriers is high during the first part of an epidemic, and that the non-carriers—being less susceptible—are attacked late in the epidemic, when there is a widespread distribution of highly infectious doses of the virus.

From the viewpoint of the statistician an influenza death is a death from influenza; from the viewpoint of the epidemiologist a death from influenza is a death from pneumonia. This distinction carries implications;

for there are several steps leading to pneumonia mortality during an influenza or other virus epidemic; moreover, each step in that series is contributory to its successor.

The primary cause of this mortality is the pneumonia-carrier state; the intermediate cause, influenza infection, and the immediate cause of death pneumonia infection. Antecedent to all these is a basic cause—remote in origin—the pneumonia transmission rate. This is the heart of the problem; on it depends the pneumonia-carrier index; this in turn determines the virus disease incidence and the pneumonia mortality. The five culminative steps leading to mortality may be represented as follows: pneumonia transmission rate, pneumonia carrier index, virus disease incidence, pneumonia complications, death-rate.

Inasmuch as each step contributes to its successor, it may be concluded that preventive measures against pneumonia complications—and to a less degree against virus disease incidence—used as emergency measures during an epidemic will be ineffective. Morbidity and mortality must be attacked at their source-transmission; there the major avenues must be blocked—and continuously. This alone will prevent a piling up of pneumonia carriers during inter-epidemic periods.

Discussion.

As has been pointed out, the imperceptible workings of the four epidemiological factors can best be influenced through the first or key factor, transmission; further, it is difficult to identify all carriers; it is impossible to segregate the susceptibles, and impractical to avoid contact.

Consequently, for saliva-borne disease control the transmission rate must be reduced, i.e., the route or routes of distribution must be determined and practical means devised for blocking them.

When this research was undertaken the aim in working with the epidemiological factors was merely temporary control by blocking transmission during epidemic periods; we extended our studies of transmission, however, to include control leading to eradication.

There are three control factors leading to eradication:—

(1) Continuity of control; there must be control of distribution throughout inter-epidemic periods as well as during epidemics.

(2) Percentage of transmission blocked: if there is but a single avenue of dissemination, as in malaria, more than fifty per cent of the transmission must be *continuously* blocked.

(3) Evaluation of the various avenues of transmission; if there are two or more avenues of distribution their relative importance must be determined; then the major avenue or avenues *continuously* blocked to an extent of more than fifty per cent of the total transmission.

From a practical point of view it is impossible to control permanently, or even temporarily, any epidemic except through the checking of transmission between the group of unrecognized cases, convalescents, and healthy carriers, and the susceptibles with whom they come in contact.

There is, then, a vast difference between temporary measures, quarantine of patients, isolation of carriers, segregation of susceptibles, avoidance of contact, and the continuous blocking of transmission during inter-epidemic periods.

During an influenza or measles epidemic every effort is made, by avoidance of crowds, quarantine, etc., to control the spread of the disease. These temporary measures are helpful, but ineffective in that they can be neither continuous nor permanent. During the epidemic there is a high distribution and contact rate, and a high sick rate with a resultant reduction in the susceptibility rate. Lack of susceptible contacts draws the epidemic to a close. Such temporary measures as had been taken are then allowed to lapse; as time passes there emerges another group of susceptibles, and again an epidemic arises to be terminated in its turn by lack of susceptible contacts.

Measures which will control an epidemic by blocking transmission between healthy carriers and susceptibles, will, if continuously applied, prevent entirely, or mitigate the severity of, future epidemics. We have had repeated epidemics of influenza and measles; there is still a high mortality from tuberculosis and pneumonia. The difficulty has been that we have had no measures for blocking the chief avenues of distribution which would protect all the people all the time. The result has been repeated epidemics of the saliva-borne diseases.

Who knew whether or not the pasteurization of milk would reduce infant mortality until the theory was put to the test? There is no difference fundamentally in the prevention of pneumonia among adults and cholera infantum among infants. In both instances the control measures must be continuous. Who knew that mosquito control would eradicate yellow fever from North America? Finley advanced the theory, Reed proved it, and the control of this disease—through blocking transmission—has limited it to a few scattered foci. We no longer burn villages as an epidemic expediency, but control distribution by continuously blocking distribution. We do not purify our public water and milk supplies merely during typhoid outbreaks. It has been the unceasing blocking of distribution through those major avenues which after years has resulted in a cumulative reduction in typhoid mortality.

This success in the control of these infectious diseases has been based on the first, or prime, epidemiological factor; discovery of the main avenue, or avenues, of transmission, followed by the continuous blocking of these avenues.

A similar method of approach towards control of the saliva-borne diseases has been followed in the research here reported. Through field observations on the method of washing mess kits during the early part of the war it appeared that there was a possibility of transmission through this multiple indirect avenue of distribution. There was a striking similarity in the transfer of organisms from the oral cavity of one soldier to that of

another, and in the transfer of a culture from one test tube to another in the laboratory.

On the basis of the theory of mess-kit wash-water distribution of the saliva-borne diseases, a statistical study of the 1918 influenza-pneumonia epidemic indicated that the warm water was responsible either directly, or indirectly, for about eighty per cent of the influenza incidence in the large groups under observation. The immediate transmission from man to man was through the contaminated mess kits and hands; in addition, there was more extended transmission through the distribution of hand contamination through inanimate objects commonly handled by the group.

While the last mentioned study covered only the time of the influenza epidemic we have presented additional statistical data covering the much longer period of ten months. Here we have an observation extended to include the other saliva-borne infections, and here, as in influenza, the warm mess-gear wash-water is shown to be the central focus of distribution, with the hands and mess gear the major avenues of transmission.

The statistical evidence that the warm mess-kit wash-water was the chief focus of distribution, and the hands and mess gear the major avenues of dissemination is confirmed by the laboratory research on the five-link chain of transmission. The links through many laboratory tests were united into a complete chain.

The influenza rate as based on the method of washing table utensils in public institutions showed that seventy-five per cent of the total disease occurred in those institutions where the hand-washing method was employed. Eating-utensil distribution would then appear to be the major avenue of influenza transmission in these institutions. Among civilian groups carelessly washed table utensils appear to be responsible for two-thirds of the influenza incidence. Thus table utensils are directly, as well as indirectly, one of the chief avenues of distribution.

The facility of distribution through tableware has been fully supported by the laboratory investigations here reported, especially those dealing with the transmission of tuberculosis. The isolation of pathogenic organisms from the hands of patients, and from healthy carriers, as well as from inanimate objects, clearly indicates the importance of hand-to-mouth transmission in the army and in the civil population. From the data here presented the conclusion may be drawn that there are two major avenues of saliva-borne disease distribution. These are through contaminated hand-to-mouth and eating-utensil-to-mouth transmission.

It has been pointed out in this research that in the mechanics of control leading to eradication the major avenue, or avenues, must be identified, so that fifty per cent or more of the distribution may be blocked. The research here presented supports the theory of multiple indirect transmission through hands and eating utensils. That these are the major avenues of distribution makes it possible to eliminate more than fifty per cent of the

transmission by the adoption of higher standards of group sanitation and personal hygiene. Thus there is established a control leading to eradication—a control which means a cumulative reduction in cases and carriers in each successive cycle of transmission.

BIBLIOGRAPHY.

[1] LYNCH, Col. C., and CUMMING, Lieut.-Col. J. G. "The Distribution of Influenza by Indirect Contact—Hands and Eating Utensils," *Amer. Journ. Public Health*, January, 1919.

[2] CUMMING, Lieut.-Col. J. G. "Saliva-borne Disease Transmission with Epidemiological and Bacteriological Research," *Military Surgeon*, February, 1920.

[3] CUMMING, Lieut.-Col. J. G., and SPRUIT, Capt. C. B. "Transmission of the Pneumonia Producing Group of Organisms," *Military Surgeon*, April, 1920.

[4] CUMMING, Lieut.-Col. J. G. "Saliva-borne Disease Transmission with Epidemiological and Bacteriological Research," *Military Surgeon*, February, 1920.

[5] NICHOLS, Major H. J. "Bacteriologic Data on the Epidemiology of Respiratory Diseases in the Army," *Journ. Lab. and Clin. Med.*, May, 1920.

[6] WEAVER, J. E. "The Germicidal Properties of Soap," *Journ. Inf. Dis.*, 1925, xxxvii, 181.

[7] LYNCH, Col. C., and CUMMING, Lieut.-Col. J. G. "The Epidemiology of Influenza-Pneumonia," *Journ. Lab. and Clin. Med.*, March, 1920.

[8] CUMMING, Lieut.-Col. J. G. "Influenza-Pneumonia as Influenced by Dish-washing in Three Hundred and Seventy Institutions," *Amer. Journ. Public Health*, November, 1919. Concluded July, 1920.

[9] *Idem.* "Can the Tuberculosis Transmission Rate be Reduced?" *Journ. Amer. Med. Assoc.*, April 17, 1920.

[10] FLOYD, C., and FROTHINGHAM, L. "Table Utensils as Sources of Tuberculosis Transmission," *Amer. Rev. Tub.*, 6: 51-62, March, 1922.

[11] TAYLOR, H. L. "Are Eating Utensils Carriers of Tubercle Bacilli?" *Amer. Rev. Tub.*, 5: 351, June, 1921.

[12] CUMMING, Lieut.-Col. J. G., SPRUIT, Capt. C. B., REUTER, Capt. F. A. "Saliva-borne Infections: Their Transmission Through Eating Utensils," *Modern Medicine*, July, 1920.

[13] DEARSTYNE, R. S. "Comparison of Bacterial Counts from Machine and Hand-washed Dishes and Their Significance," *Amer. Journ. Public Health*, November, 1920.

[14] CUMMING, Lieut.-Col. J. G., SPRUIT, Capt. C. B. "The Transmission of the Pneumonia Producing Group of Organisms," *Military Surgeon*, April, 1920.

[15] *Ibid.*

[15A] *Ibid.*

[16] CUMMING, Lieut.-Col. J. G., SPRUIT, Capt. C. B., LYNCH, Col. C. "The Pneumonias, Streptococcus and Pneumococcus Groups." *Journ. Amer. Med. Assoc.*, April 13, 1918.

[17] CUMMING, Lieut.-Col. J. G., SPRUIT, Capt. C. B., ATEN, Lieut. E. J. "Streptococcus Pneumonia," *Journ. Amer. Med. Assoc.*, March 8, 1919.

[18] CUMMING, Lieut.-Col. J. G. "The Streptococcus, an Ally of Smallpox," *Contributions to Medical Science*. Dedicated to Aldred Scott Warthin, 1927. George Wahr, Ann Arbor, Michigan.

[19] *Idem.* Report of the Sanitary Commission to Chief Surgeon, A.E.F., Siberia, Russia, March, 1920.

[20] CUMMING, Lieut.-Col. J. G., SPRUIT, Capt. C. B., ATEN, Lieut. E. J. "Streptococcus Pneumonia," *Journ. Amer. Med. Assoc.*, March 8, 1919.

[21] CUMMING, Lieut.-Col. J. G. "Influenza-Pneumonia as Influenced by Dish-washing in Three Hundred and Seventy Public Institutions," *Amer. Journ. Public Health*, July, 1920.

MATERNITY AND CHILD WELFARE CENTRES IN THE ALDERSHOT COMMAND.

By Colonel G. DANSEY-BROWNING, C.B.E.

At a prize meeting held in 1930 by the National Council for Maternity and Child Welfare, the National Mothercraft Shield and the Rhonda Challenge Shield for England and Wales were both awarded to a Military Centre in the Aldershot Command.

As this was the first occasion, since these competitions were started in 1913, that one Centre had obtained both these awards, the matter aroused some interest. When it became known that this Centre had also gained, on two consecutive years, the Aldershot Command Duncan Welfare Challenge Shield, and that it was the first Military Centre to compete for the National Council's awards, many questions were asked as to the origin and administration of these Military Centres.

To understand the origin of Military Welfare Centres, it is necessary to review the early history of the welfare movement in civilian life, particulars of which are to be found in the Local Government Board and Ministry of Health Annual and Special Reports. An admirable summary of this history was written by Dr. J. E. Lane-Claypon in 1920, of which the following is an epitome:—

During the latter part of the Victorian era, public attention was drawn to the relation between the vitality of a nation and the rate of increase of its child population. This increase depends on the excess of births over deaths. In countries such as France, with a practically stationary population, the effect was felt on the numbers available for the conscript army. In other countries where there was still a large excess of births over deaths, this excess was decreasing rapidly from year to year. This decrease chiefly affected the better educated classes, whilst the number of children born to the improvident tended to grow.

Economical considerations rendered large families inadvisable, so methods were sought to preserve the lives of the newly-born. The means adopted varied with localities; a number of enthusiastic ladies in different parts of the country banded themselves together to form committees with this object in view. In some towns they concentrated on home visitation, in others they organized depots for the supply of milk and artificial foods for infants. Some localities established infant consultations, others gave instruction to the mothers in infantile hygiene. In many places the work of these different committees overlapped, and the absence of professional guidance led to inadequate results.

The need for professional assistance at infant consultations and schools for mothers became apparent, as well as the need for paid health visitors. The inevitable result was increased expense.

For a time milk and artificial food depots, organized by untrained helpers, were a popular form of activity, but they gradually fell into disuse. Experience showed that they tended to reduce breast-feeding, and that the results obtained in many instances were out of proportion to the expenses incurred.

A few of these voluntary associations closed down for want of funds, but more survived. These were reorganized and worked in co-ordination with the local health authorities; they formed the nucleus of what is known to-day as the Welfare Centre, with its numerous forms of activity in every branch of maternity and infant welfare work. Lay helpers became responsible for the provision of clothing and the social activities of the Welfare Centre, whilst the nurses and trained health visitors were freed for professional work. As regards control, this varied with localities, and depended on the source of the money by which the centre was maintained. Many of the smaller centres are still controlled by voluntary associations who work in co-operation with the health authorities and receive grants-in-aid from the public purse.

The larger centres are worked by committees, which are appointed to act on behalf of the local health authority concerned. Medical supervision is provided, either by local medical practitioners, or by members of the School Medical Service, paid from county or municipal funds. Half the expenses incurred are usually met by Treasury grants, whilst advice and inspection of all State-aided centres is provided by the Ministry of Health.

Military Welfare Centres.

From time immemorial it has been the custom of the Services for an officer to look after the welfare of his men and those dependent on them. Visiting of soldiers' families is usually undertaken by the officer's wife, and material help is given as required from military charitable funds. The Soldiers' and Sailors' Families Association was founded in 1885 to coordinate this work. In 1892 a nursing branch was instituted, and in 1894 two district military nurses were appointed to the Aldershot Command. These were maintained by the Families Association; their duties were to attend the wives and children of soldiers on and off the strength, to visit these in their homes and to give advice on matters of health and hygiene. A ladies' local committee was formed in the Aldershot Division to supervise all details connected with their work, under the direction of H.R.H. Duchess of Connaught, President of the Aldershot branch of the Soldiers' and Sailors' Families Association.

The next development of the movement in the Aldershot Command took place during 1899, at the commencement of the South African War, when a number of soldiers' families remained in barracks after the departure of the troops. The need for the formation of a home, where children could be received in the event of their mothers falling ill, led to the foundation of a crèche in an officers' disused quarter on Middle Hill. This was gradually

improved and extended, and an isolation block for the reception of children on admission was constructed in 1911.

Her Majesty the Queen has taken a special interest in this crèche, and authorized it to be called Queen Mary's Home.

Education in elementary hygiene was the next step. In 1912 classes were organized by Mrs. Guise-Moores, and instruction was given in home nursing and first aid; invalid cooking was also taught by the Serjeant Master Cook at the Connaught Hospital. These classes subsequently expanded and were held at Government House, and later in a hall in Farnborough, where weekly demonstrations were given. During the war these activities were carried on by our civilian colleagues.

In 1919 the need for co-ordination in these activities became apparent; Mrs. Guise-Moores and Brevet Lieutenant-Colonel F. D. G. Howell, R.A.M.C., visited the St. Pancras Welfare Centre and organized one on similar lines in the Stanhope Lines. From the commencement this was a success and, with the active support of Lady Rawlinson, similar welfare centres were opened at Bordon and in other parts of the Aldershot Command.

The Aldershot Division of the Soldiers' and Sailors' and Airmen's Families Association was reorganized and its present constitution evolved gradually. In 1920-21, quarters in barracks were provided for Soldiers', Sailors'. and Airmen's Families Association Nurses in Wellington, Stanhope, and Marlborough Lines, as well as at Bordon, Ewshott and Blackdown; in 1925 a similar centre and nurses' quarters were provided at Longmoor.

Maternity and Ante-Natal Work.

Since the opening of the Louise Margaret Hospital, wives of soldiers on the married strength have been admitted for their confinement, whilst those off the strength are taken in as accommodation permits.

Pre-natal clinics were first instituted in connection with such cases by Major E. C. Moss in 1923. Cases which cannot be admitted to the Louise Margaret Hospital are dealt with under the County Maternity Scheme; they are attended in their confinement by district midwives, and medical aid when required is provided from an insurance fund.

At Bordon a special midwife was provided for attendance on military maternity cases in their homes in that district in 1915, and this arrangement has been carried on up to date.

Other Forms of Activities.

The usual informal talks and lectures on mothercraft are given in all our Military Centres, a special feature of which is the care of children when proceeding abroad. From time to time special demonstrations are given, films are shown, and various speakers obtained from welfare headquarters. Classes are held for cutting out and making clothes, model garments are

provided and sold at cost price. Milk and infant food are also issued from the centres at wholesale price, when ordered by the medical officer.

Curative Work.

The medical officer in charge of the Welfare Centre is responsible for care of the wives and families, and obtains for them specialist's advice if required. Liaison is maintained by him with civil institutions, and special modes of treatment are arranged by him in cases of necessity.

A Baby Week was held at Longmoor Camp in 1930 and was attended by representatives of welfare centres from many parts of the county.

Constitution and Financial Control.

The sole financial assistance Military Centres receive from the Treasury is an initial grant of £6 and an annual grant of the same amount. These grants are ear-marked for the purchase of crockery, wall charts and diagrams at the discretion of the medical officer, and cannot be used for other purposes. In addition to this, material assistance is given by the Army Council in permitting its medical and engineer officers to assist the Welfare Committee in a professional capacity and in granting leasehold rights on welfare buildings erected on War Department land. These buildings are built and maintained by the Aldershot Command Trust, of which the official custodian is the United Service Trustee.

The Centres are administered by the Aldershot Division of the Soldiers', Sailor's and Airmen's Families Association, by whom the nurses are appointed, although they are maintained by the Trust. The General Committee of the Division is under the presidency of the wife of the G.O.C., Aldershot Command. There are five area committees, two of which have as vice-presidents the wives of the Divisional Generals, two the wives of Brigade Commanders, and one the wife of the D.D.M.S. of the Command. The members are wives of representative Officers Commanding Units in each area.

A separate Nursing Committee, under the presidency of the head of the General Committee, has been formed, on which is a representative lady from each of the districts in which a Soldiers', Sailors' and Airmen's Families Association nurse is employed. The vice-president of each area committee nominates a lady-in-charge of welfare work in each district, to co-operate with the medical officer, and to direct the nurse's work. The nurse is directly responsible to her for all except purely nursing duties.

The constitution has many advantages. The president and members of the committee have no official status and are thus free from Government interference in their work. At the same time, as wives of heads of military units, they are in direct touch with official opinion, and can easily obtain assistance and advice. On joining these committees, they may or may not have had any previous acquaintance with welfare work. Their

interest and knowledge may date from the time that their husbands obtained higher rank. In practice, however, this is exceptional. The lady-in-charge of the welfare work co-operates in all matters with the medical officer concerned and makes known his views at the meetings of committee. In this way indiscriminate issue of artificial food and unsuitable modes of relief are avoided.

The Future.

In my opinion the future of the military welfare movement will depend on the continuance of the happy relations and co-operation which have up to now existed between area committees and the Army Medical Staff. Each must respect the autonomy and the province of the other and neither encroach on the other's sphere of action or initiative. Co-operation is required to maintain efficiency and to secure co-ordination in all practical arrangements, and thus only will the interest of the mother and child be served. As regards further development, efficiency and economy have been secured by affiliation between our Military Centres and the Constituent Societies of the National Council for Maternity and Child Welfare. Further activities, however much needed, mean recurring expense, and this would have to be financed by the Aldershot Trust. In case of mobilization the principal sources of the income will be cut off, so great economy is needed in times of peace, to enable essential services to be carried out in the event of an outbreak of war.

Acknowledgment.

It is impossible in the space at my disposal to mention the names of any but a few of the ladies and officers to whose zeal, tact and energy the success of the Aldershot Military Welfare Movement is due. I can recall Lady Haig, Lady Rawlinson, Lady Duncan, Lady Guise-Moores, Lady Strickland, and more recently, Mrs. Lister, whilst amongst the officers there were Lieutenant-Colonel Howell, Colonel Easton, Lieutenant-Colonel Davy and Lieutenant-Colonel Moss, Major-General Harding-Newman and Major-General Guise-Moores. I owe thanks to Major Sharp, Hon. Secretary of the Aldershot Trust, and to the Secretary of the Soldiers', Sailors' and Airmen's Families Association for information, and also to the D.D.M.S., Aldershot Command, for permission to publish this article. I am indebted to the librarian of the British Medical Association for looking up references.

References.

[1] "The Child Welfare Movement." By Dr. J. E. Lane-Claypon.

[2] "The Military Children's Welfare Centre." By Mrs. Lister, *The Journal of the Royal Army Medical Corps*, vol. 1, 1928, p. 344.

[3] The "Green Book" of the S.S.A. Families Association, Aldershot, Military Division, p. 17.

[4] Annual Reports of the Soldiers' and Sailors' Families Association.

Editorial.

ON THE STATE OF THE PUBLIC HEALTH IN 1929.

THE population of Great Britain in 1929 was 44,491,000. This includes the population of England and Wales, 39,607,000, an increase of 125,000 on 1928.

In his report for 1928, the Chief Medical Officer of the Ministry of Health pointed out the changing constitution of the population, with the result that the average age is steadily rising. This change will be unfavourable, as those living will be of ages subject necessarily to relatively high rates of mortality. In 1928, the birth-rate exceeded the death-rate by 5 per 1,000, the natural increase of the population was therefore 5 per 1,000. This is less than half the figure which obtained in 1921-25. In 1929, there was a further decrease in the birth-rate, and a substantial increase in the death-rate, so that the natural increase of the population was reduced from 5 to 2·9 per 1,000. We are thus rapidly approaching a stationary population.

In 1929 there were 643,673 births, the lowest number recorded for many years. The deaths numbered 532,492, which is 72,103 more than the previous year. The number of births has steadily decreased since 1911-20, when the birth-rate was 21·8 per 1,000 living ; it is now only 16·3 per 1,000 living, and owing to a rise in the infant mortality in 1929 of the few children born still fewer survived the first year of life.

The principal causes of death were :—

	Number per 1,000 deaths.
Diseases of heart and circulation	225
Bronchitis, pneumonia and other respiratory diseases ..	157
Cancer, malignant diseases	107
Diseases of the nervous system	82
All forms of tuberculosis	71

The order of precedence is the same as last year. But in 1929 there were 29,084 deaths from influenza compared with 7,754 in 1928. Respiratory diseases, including bronchitis and pneumonia, also increased as a result of the outbreak of influenza.

There is no complete registration of sickness in England and Wales, but for many years the principal infectious diseases have been notified. In 1929 there was an increase in the prevalence and mortality from pneumonia following on the outbreak of influenza. The incidence and mortality from typhoid fever decreased, while the incidence and mortality from scarlet fever increased. The incidence and mortality from encephalitis lethargica, which usually follows the curve of influenza, has not done so this year and a slight decrease is recorded.

In England and Wales during 1929 sickness and invalidity caused a loss to the nation, among the insured population only, and excluding loss due to sickness for which sickness or disablement benefit is not payable, of 29½ million weeks' work, or the equivalent of twelve months' work of about 567,000 people. The medical records of 698 practitioners in some 500 representative areas of England and Wales were examined in 1928. The chief causes of sickness were found to be respiratory diseases and abnormalities of the digestive system, which had about the same incidence in men and women. Injuries, lumbago, rheumatism and septic conditions formed three large groups, followed by diseases of the nervous system.

During the past year great interest has been taken in questions of maternity and child welfare. The deaths of women classed to pregnancy and child-bearing have remained nearly stationary for several years. The rate for 1929 as a whole is slightly lower than that for 1928, namely, 4·33 per 1,000 births instead of 4·42, but the deaths from puerperal sepsis are slightly more numerous.

The northern districts show a high general mortality and the highest infant and maternal death-rates. In London the maternal death-rate both for puerperal fever and other causes is lower than in any other part of the country. The favourable position in London is partly due to the presence of large maternity hospitals, midwifery training centres and medical schools, which offer cheap and carefully supervised maternity services, and also possibly to the small number of abnormal confinements. There is less rickets in London than in Yorkshire and Lancashire and therefore less risk of pelvic deformity leading to difficult labour.

The Interim Report of a Departmental Committee on maternal mortality and morbidity was issued in August, 1930. This committee investigated the causes of maternal mortality in 2,000 cases. They found that of the causes of death brought to their notice 50 per cent were preventable. In only 5 per cent was there an absence of reasonable facilities for effective medical care, but in 43 per cent there was an absence of antenatal care, or errors of judgment by the doctor or midwife, or negligence of the patient. The remedy for the excessive maternal mortality was obviously in the care of the individual mother. Sir George Newman says we now know more or less exactly where the shoe pinches. Three paramount practical conclusions emerge. First there is an absolute need for effective antenatal supervision of every case of pregnancy. Secondly there is a relative need for improved obstetric practice—on the part of doctors and midwives—antenatal, at childbirth, and postnatal; and lastly there is a relative need for the fuller completion of local organization to provide, and make available, all the necessary facilities for an effective service.

In the Insurance Medical Service there are 15,000 medical practitioners engaged on what is popularly called curative work. But Sir George Newman states that an analysis of the facts does not justify a sharp

division of the practice of medicine into curative and preventive groups. In the early diagnosis of tuberculosis, and in showing the patient how to become less dangerous to others, the medical practitioner is doing preventive work. The early detection of infectious disease is preventive work of great importance. In the prevention of rheumatism, bronchitis and dyspepsia, which cause much ill-health, he can also do much. From the nature of his work the medical practitioner is in a position to see disease in its early stage, when it can be attacked with the greatest hopes of success.

The number of insured persons in England and Wales who in the year 1929 were entitled to medical benefit under the National Insurance Acts was 14,959,000. Most of these people obtain treatment from insurance practitioners. Only some 25,000 obtained permission from their respective Insurance Committees to make their own arrangements for treatment.

The cost of medical benefit was £9,222,941. Of this sum £6,898,140 was expended on the remuneration of practitioners and £2,324,801 in the supply of medicines and drugs.

In 1926, 1927, 1928 and again in 1929 there was a marked increase in the number of persons claiming sickness and disablement benefit. Sir George Newman says this is certainly not due to an increase in sickness in the community in general. There has been a certain amount of loose certification, but he does not think this is the sole cause. The Government Actuary has made an examination of the sickness and disablement experience of a group of Approved Societies over the period 1921-27. He finds that the increase is most pronounced in claims of short duration. As regards sickness benefit, the claims of men have risen by 41 per cent, those of unmarried women by 60 per cent, and those of married women by 106 per cent. Further investigations are now being made on cases referred by Approved Societies to the Regional Medical Officers.

In the year 1929, 10,967 cases of smallpox were notified in England and Wales. Compared with 1928 there is a decrease of 1,450 cases and the diminution is most marked in the counties lying north of Leicester. By far the greatest incidence has been in the East End of London and the adjoining parts of Essex.

The disease was generally of a mild type, with a case mortality rate of only 0·2 per cent. Severe smallpox was introduced into Liverpool from India by the s.s. "Tuscania" in April, 1929, some 35 cases with 11 deaths subsequently occurring in England and Wales. They were marked by severe prostration, hæmorrhages into the skin and a confluent eruption.

The Committee on Vaccination continued to sit at intervals as occasion demanded and the new Vaccination Order, which implemented certain of their recommendations, was issued in August and came into operation on October 1. The Order advocates the substitution of one vaccine insertion for the four previously advised, and provides for the gratuitous revaccination of any person at any time. It expresses the Minister's view that so long as smallpox prevalent in this country retains its present mild character, it

is not generally expedient to press for the vaccination of persons of school age and of adolescents who have not previously been vaccinated, unless they have been in personal contact with a case of smallpox or directly exposed to smallpox infection.

The Report by Professor Le Gros Clark on an "Anatomical Investigation into the Routes by which Infections may Pass from the Cavities into the Brain" was published by the Ministry in July, 1929. Professor Le Gros Clark has succeeded in demonstrating that fine particulate matter can pass from the nose of a rabbit into the brain in one hour, a phenomenon not hitherto observed.

The Committee have continued to collect information about, and to investigate, cases of central nervous disease following within four weeks of vaccination. The total number of cases collected is now 187, with 97 deaths; this represents a ratio of cases to vaccination of under 3 per 1,000,000. The inquiries of the Committee confirm the histological findings of Perdrau and of Turnbull and McIntosh in cases of post-vaccinal encephalitis.

The Committee emphasized the importance of research work directed towards the exploration of the possibilities of the use of a further attenuated, or even a killed virus, as an immunizing agent. Work of this kind is being carried out at the London Hospital under the supervision of Dr. Bedson.

During the year 1929 there were notified in England and Wales 2,835 cases of enteric fever (including paratyphoid fever) as compared with 3,495 cases in 1928, and 3,533 in 1927. No precise information is available respecting the relative incidence of typhoid and paratyphoid infections throughout the country.

Notes on three outbreaks of typhoid fever investigated by the medical officers of the Ministry are given.

There were 120 cases at Sydenham, Beckenham and Penge, and the source of infection was believed to be unwrapped cooked foods obtained from a certain shop. How the cooked food became infected is not clear, but the balance of evidence seemed to favour slightly an employee, who died from a typhoid relapse, as the source of the outbreak.

An outbreak in the Liskeard Rural District was attributed to infected water in which milk utensils were washed.

In the Northfleet Urban District nineteen cases occurred with seven deaths, but though the outbreak was supposed to be caused by infected food, no definite source could be traced.

The difficulties in making an early diagnosis of typhoid fever are well known, and Dr. Scott of the Ministry's laboratory has furnished a note on the agglutination test which the Ministry believes will be of great service to Medical Officers of Health.

The agglutination test may fail to give positive indications in cases in which the clinical facts suggest the probability of typhoid infection, and even in cases in which the specific bacilli have been cultivated from the blood or

fæces. Dr. Scott states that the negative results may be due to the fact that some patients do not develop agglutinins, or the test itself may be at fault. It seems to be true that about five per cent of patients do not develop agglutinins, but the main cause of failure lies in the way the test is usually performed. Dr. Scott insists on the importance of employing the somatic agglutinin as an index of typhoid infection and the improved technique which he recommends "consists in the employment of cultures of the typhoid bacillus freed from the flagellar element and thus sensitive to somatic agglutinin, since the ordinary flagellated culture, though it contains the somatic element, has its somatic agglutinability inhibited to a greater or less extent by the coating of flagellar material." Liberation from flagella can be obtained by heating a culture to above 60° C., by suspension in alcohol, or by growth on media containing carbolic acid; but "perhaps the most suitable material is a strain which has appeared spontaneously as flagella-free. Such strains are probably not uncommon, but that known as O901, isolated by Felix and Olitzky, and maintained in the National Collection of Typed Cultures, appears to be stable and peculiarly sensitive to somatic agglutinins."

According to Dr. Scott one of the great advantages of using the somatic agglutinin is "its absence in the so-called anamnestic rise of agglutinin titre observed in inoculated persons, or former enteric cases who become subjects of non-enteric infection; this latter phenomenon has been a constant difficulty in the application of the ordinary test in such cases. In subjects who have recently received protective inoculation with T.A.B. vaccine the somatic agglutinin is habitually absent or imperceptible, though exceptions occur, whereas in 'carriers' the titre for somatic agglutinin equals or exceeds the titre for flagella agglutinin, i.e., for the ordinary test." Major Whitehead has, however, shown that while O agglutinins are more closely identified with the actual disease of typhoid fever than are H agglutinins, yet they may be present in significant amount in inoculated soldiers who have never suffered from typhoid fever.

The Medical Research Council have issued a revised pamphlet available at the Standards Laboratory, Oxford, in which will be found full details of the improved test.

There have been no extensive outbreaks of diphtheria during the year, except at Poole where 237 cases with 12 deaths occurred. Immunization against diphtheria is making progress, and a number of Local Authorities have established clinics and are immunizing children at school. It has been suggested that immunization should be limited to inter-epidemic periods, but this limitation is not necessary. Toxoid-antitoxin mixture (T.A.M.) is the prophylactic most used, and has proved safe and satisfactory. Experience shows that better results are obtained if an interval of two to three weeks is allowed between the doses.

There have been several outbreaks of scarlet fever in Rural and Urban Districts. The cases were usually mild with only sore throat and slight

glandular enlargement. Rashes were frequently absent, and diagnosis, therefore, was difficult. The disease was spread by case to case infection.

The opinion seems to be growing that the causal organism of scarlet fever is a hæmolytic streptococcus of which there are several strains, and that the clinical differences in outbreaks can be accounted for by variations in the strains responsible. Associated with scarlet fever there appear to be four chief serological types, and "a group composed of strains with individualistic characters." In several outbreaks Dr. Griffith has fully confirmed the special significance of the major scarlatinal types. Tonsillitis and sore throat not accompanied by rashes he has found to be almost invariably associated with hæmolytic streptococci of the heterogeneous type.

There was a severe outbreak of streptococcal tonsillitis in Brighton and Hove in 1929. More than a thousand families were affected and there were sixty-five deaths. The outbreak was traced to the milk of a certain farm where there had been several cases of illness. Hæmolytic streptococci were isolated from the patients both in Brighton and at the farm, but they could not be found in the milk.

There were 3,388 deaths from measles in 1929, compared with 4,302 in 1928. Many local authorities are making arrangements to obtain a supply of serum from convalescents from measles. Deptford was the first to initiate a scheme, the blood being collected at a local hospital and prepared at the Wellcome Research Laboratory. Patients in the infectious hospitals of the London County Council are being treated with serum to prevent the spread of infection in wards. Treatment with serum cannot be expected to lessen the general incidence of measles, nor would this be altogether desirable, as measles is always most severe in a community unprotected by previous exposure. But it may preserve many a young child from death.

When serum cannot be obtained from persons who have recently had measles, that of persons who have had the disease many years before may be used. Serum of this nature has been employed at the West Bromwich Fever Hospital with good effect.

In March, 1930, two patients believed to be suffering from typhus were admitted to the Western Infectious Hospital. Inquiry showed that they were suffering from glandular fever, and other cases of the same nature were found in St. Bartholomew's Hospital and the London Hospital. The chief symptoms of the disease are a mild pyrexia and enlargement of the glands, usually in the neck. The most characteristic feature of the disease is a relative lymphocytosis in which the lymphocytes may constitute 85 per cent of the white cells, without any increase, or rarely so, of the total white cell count.

From January 1, 1919, cerebrospinal fever, poliomyelitis with polio-encephalitis and encephalitis lethargica, have been notified and have been responsible annually for a minimum of 1,184 cases in 1922, to a

maximum of 6,296 in 1924. In 1927, which may be regarded as an average year, the deaths were 1,767. The maximum incidence of encephalitis lethargica was in 1924; since then there has been a marked decline, in 1929 the cases were only one-fifth of those reported in 1924. Since 1919 the notifications of poliomyelitis and polioencephalitis have fluctuated, reaching a maximum in 1926, when 1,297 cases were notified. The seasonal trend is similar to that of enteric fever, with an autumnal maximum. Recent investigations in Greenland indicate that the disease is of great antiquity in Scandinavian countries. It then disappeared, but reappeared in northern Europe in the second half of the nineteenth century and is now steadily spreading.

In 1915 there were 2,203 deaths from cerebrospinal fever; in 1919 there were 694 deaths; in 1923 the minimum was reached when only 294 deaths were registered. Since then there has been an upward trend, and in 1929 there were 588 deaths.

The carrier has been accepted as the chief means of spreading cerebrospinal fever. Experiences in the Great War showed that by preventing overcrowding much can be done to arrest the disease. The majority of observers seem to think that infection from encephalitis lethargica and poliomyelitis is through the upper respiratory passages, and the relief of domestic and extra-domestic overcrowding seems, with our present knowledge, to be the best means of prevention.

In 1929 the crude annual death-rate from acute rheumatism fell to 36 per million living, the lowest on record. The chief importance of this disease is the invalidity from heart disease which it produces.

For the supervision of children who have signs of rheumatism, or who have had attacks or who have been discharged from hospital, the Rheumatic Supervisory Clinic has been established, which should act in close liaison with the school medical officer, care committees and branches of the Invalid Children's Association. There were fifteen rheumatic centres in London by the middle of 1930.

There is some difference of opinion as to the preventive value of the rheumatic clinics or centres. Some medical officers believe they are of great value. On the other hand, Drs. Findlay, Macfarlane and Stevenson, from their observations, conclude that regular supervision at out-patient clinics does not diminish the recurrence of rheumatic infection, nor does it seem to affect markedly the progress of rheumatic heart disease. There is, however, general agreement as to the value of the special country cardiac hospital, home of recovery, or residential school for the latter purpose. Dr. Findlay found that the recurrence rate of children treated at the country cardiac hospital was only half that in the children attending the out-patient clinic.

The value of tonsillectomy, which for many years was considered one of the most important parts of the prophylactic treatment of rheumatism, especially against relapse and carditis, has been questioned recently by

many authorities. Sir George Newman, summing up the position as it exists to-day, says that no case has been made for the removal of apparently healthy tonsils in the rheumatic child simply as a measure of prophylaxis against acute rheumatism. Removal should only be attempted when there is definite local disease, and the enucleation should be complete. When there has been acute inflammation of the tonsil it is wiser to wait for it to subside before operation.

We hope to conclude our review of Sir George Newman's interesting report next month, when we shall give a short statement of the new duties of a Medical Officer of Health acting as adviser of a County Council or Borough County Council, consequent on the coming into force of the New Local Government Act.

Clinical and other Notes.

A CASE OF SPINDLE-CELLED SARCOMA OF THE ANTERIOR MEDIASTINUM.

By Major J. M. MACFIE, M.C.
Royal Army Medical Corps.

On account of its interest as regards differential diagnosis, and because it illustrates the early and late phases of that bugbear of the pathologist, "the border-line neoplasm," it is thought that a short description of the following case would not be out of place.

The patient was a gunner, examined for enlistment at Liverpool on April 16, 1923, when he was 18 years and 3 months old. His calling was that of motor driver. His weight on enlistment was 132 pounds, and the only defect noted was a slight hammer-toe.

On March 25, 1925, a small tumour ($\frac{3}{4}$ inch diameter) was removed from the skin of the upper aspect of the right shoulder under novocain. On section it suggested a fibroma with hæmorrhagic areas, and it was sent to a pathologist for report.

The laboratory report described the growth as a very cellular soft fibroma, not malignant, but prone to local recurrence unless fairly widely excised.

The only other admission to hospital, noted on his medical history sheet, was to the British Military Hospital, Nowshera, on April 5, 1927, where he died on May 18 from a neoplasm of the anterior mediastinum.

His complaint, on admission to hospital, was of pain in the front of the chest. He stated that an uncle had died of tuberculosis, but that all the members of his own family were alive and well. The only illness to which he admitted was the small growth on the right shoulder removed two years before.

For six months before admission he had been working as a nursing orderly in the hospital, and on March 29 he experienced a slight pain over the right upper half of his chest in front. This pain gradually became worse, and he noticed that his temperature in the evening rose to about 100° F.

His condition on admission to hospital on April 5 was as follows:—

He was a fairly well-developed, muscular man, weighing 134 pounds. Five weeks previously his weight had been 147 pounds. He liked to be propped up in bed, as lying flat was liable to bring on a sensation of choking. There were marked night sweats.

He complained of a constant pain over the right upper half of the chest in front, the pain being increased on coughing, which was frequent,

harsh, and dry in character. Sputum was very scanty and consisted of mucus, tinged occasionally with blood. Breathing was slightly harsh. Both sides of the chest moved freely and, on the right side, pulsation could be seen over the first and second interspaces close to the right border of the sternum. Percussion revealed dullness over the lower portion of the manubrium sterni, extending on the right side for two inches beyond the right border of the manubrium, and continuous below with cardiac dullness. No change was discovered over the remainder of the lung. No breath sounds could be heard over the dull area to the right of the manubrium sterni, but, over the rest of the right lung the breath sounds, though faint, were not abnormal; neither was any abnormality detected in the breath sounds over the left lung. Vocal resonance was absent over the dull area, but was unchanged over the remainder of the chest.

The pulse was of moderate tension, rate 104, and rhythm regular; the apical pulsation was in the fifth interspace immediately below the left nipple. No enlargement or displacement of the heart was discovered by percussion. At the apex and pulmonic areas the heart sounds were healthy, but no sounds could be heard over the aortic area.

The tongue was clean, the teeth in good condition, and there was no irregularity of the bowels. The spleen and liver were not enlarged.

A potassium iodide mixture was ordered.

The notes which follow indicate the progress of the case until he died, forty-four days after admission to hospital.

April 7. Condition much the same. Slept well. No tubercle bacilli found in the sputum.

April 9. No change. Potassium iodide mixture stopped.

April 13. States that when he moves from his right to his left side, he feels as if a weight were moving inside his chest to the left side.

April 14. A radiogram of the chest was taken and it was reported that there was evidence of a tubercular lesion in the right apex, but the radiogram was not satisfactory. No tubercle bacilli were found in the sputum. Leucocytes numbered 6,550 per cubic millimetre and erythrocytes 4,237,500.

April 16. The pain on the right side of the chest is becoming worse. Cough remains the same. Sleeping well.

April 19. Weight 132 pounds, a loss of two pounds since coming into hospital.

April 21. Dyspnœa more marked. Both pupils equal in size. No difference in the radial pulses of the right and left side.

April 23. Complaint of pain under the left clavicle and also in the fifth interspace on the right side.

April 25. Seen by the officiating medical specialist. A diagrammatic representation of his findings is given in fig. 1, and the points to which he drew attention were as follows:—

A young man, aged 24. Town dweller. Illness commenced with hæmoptysis. No history of rheumatic fever. Tumour (? fibrosarcoma)

cut out of shoulder two years ago. Family history negative. Symptoms are advancing quickly. Hectic flush both cheeks and sweating (possibly heat, possibly infection). Low irregular fever with daily remissions. Dyspnœa marked, with stridor. Orthopnœa. Insomnia. Wassermann reaction not done. Leucocytes 6,000.

On the physical signs elicited the most probable diagnosis is new growth or aneurysm. Fever and history of a doubtful tumour are in favour of new growth.

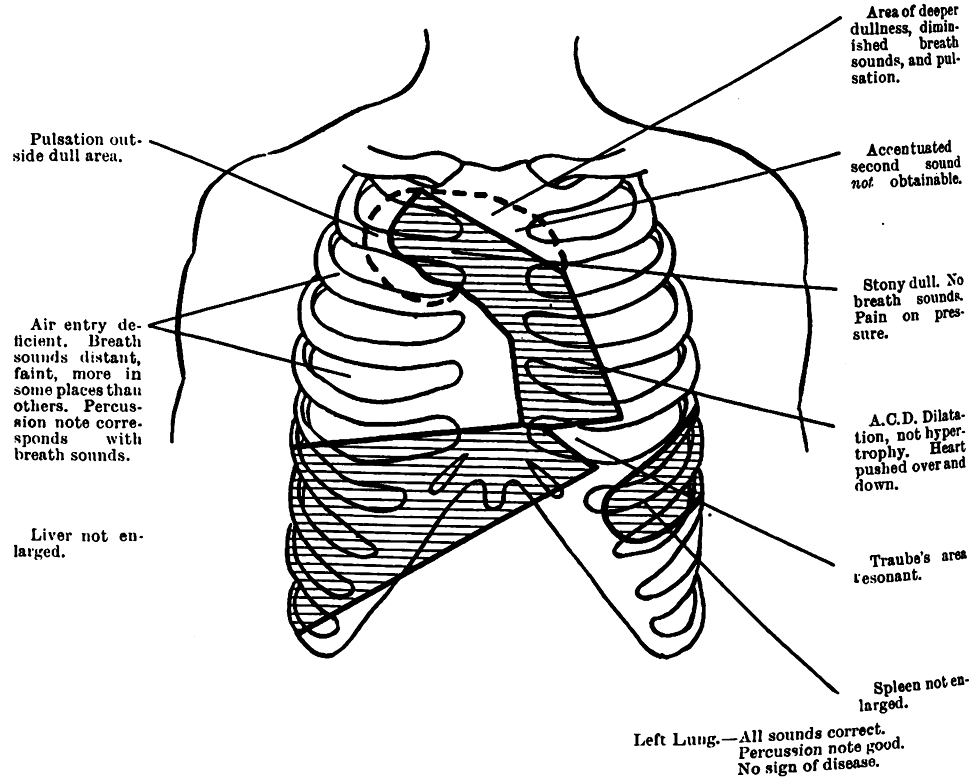


FIG. 1.—Signs on April 25, 1927.

The youth of the patient, the facies, flush, fever and hæmoptysis make one think of tubercle. Against tubercle are the following points :—

(1) Absence of typical signs of tubercle.

(2) The dyspnœa is too great for a man with one sound lung, lying in bed.

(3) Orthopnœa is very rare in tubercle, more like a heart condition.

(4) Absence of tubercle bacilli in sputum on repeated examination.

(5) Sputum not like that of tubercle in kind or in quantity.

(6) No lymphocytosis present.

The points against pericarditis are absence of the typical dullness

(pulsation away from the dullness and Traube's area resonant) and no previous history of rheumatic fever.

Mitral stenosis and bronchiectasis are ruled out by lack of evidence.

Suggestions: Watch carefully for any confirmatory signs of aneurysm, especially anginal attacks and paroxysmal dyspnœa.

Ask the throat specialist if there is any paralysis of the vocal chords or ulceration of the trachea and larynx.

Obtain a good radiogram of the chest, both antero-posteriorly and laterally. Screen for dilated aorta.

Continue to look for tubercle bacilli and repeat the total and differential leucocyte count.

Have the Wassermann reaction done.

Give morphia and paraldehyde or chloral to obtain sleep.

April 27. Pain now present over the whole chest in front, and interfering with sleep. Weight 132 pounds; sputum repeatedly examined for tubercle bacilli with negative results.

April 30. Pain in chest very severe. Morphia, $\frac{1}{4}$ grain, given at night.

May 2. Cough has a harsh, clanging sound. Sputum scanty, mucopurulent, tinged with blood. Respiratory rate increasing. Percussion over the front of the chest causes very severe pain. Heart dullness increased downward and to the left. Posteriorly, breath sounds are very faint over the left lung. Vocal resonance is unchanged. Over the right lung posteriorly the breath sounds are faint, but louder than those heard over the left lung.

May 7. Pain worse, and morphia has to be given at night. Does not wish to eat and refuses to be radiographed again.

May 10. Pulse increasing in rate and becoming feeble. Food vomited about an hour after ingestion, apparently not due to pressure on the œsophagus.

May 13. Pain very severe. Very restless night. Refuses practically all food. Face and lips, hands and upper part of trunk slightly swollen.

May 15th. Œdema in arms disappeared. Feet slightly œdematous. Pain very severe.

May 18. Died.

During the time he was in hospital the pulse rate increased steadily from 76 to 140, and the respiration rate from 20 to 38. The temperature varied between 97° F. and 102° F., being steadily above normal from April 19 till May 9, when it became subnormal and remained so, with the exception of one evening rise to 100° F., until the end.

A post-mortem examination was performed on the evening of May 18, six hours after death, and the following relevant findings are recorded:—

There were numerous dark brown petechiæ over the chest and face, but no dilatation of the superficial blood-vessels. There was blood-staining on the lower lip. On the crest of the right shoulder, half-way between the acromion and the root of the neck, was a round, puckered scar, $\frac{3}{4}$ inch

in diameter. On the circumference of this scar could be felt some small, rather hard nodules, about $\frac{1}{8}$ inch in diameter. None of the superficial glands were markedly enlarged. There was œdematous swelling over both ankles, more marked on the right.

The abdominal cavity was free of fluid. The liver was enlarged (ninety-four ounces), brown in colour, very greasy to the touch, and contained about half a dozen round white nodules, the largest of which was $\frac{3}{8}$ inch in diameter. Two of these were superficial, but were not raised above the general surface. Apart from some moderately enlarged mesenteric glands, no other abnormality was found.

When the chest was opened, it was found that the parietal pleura was disorganized and friable on the left side, and the left pleural cavity full of a golden coloured, clear fluid of the consistence of serum, which escaped as soon as the sternum was removed. There was a small quantity of serous fluid in the right pleural cavity. When the sternum and costal cartilages were removed, it was found that nothing presented but a mass of new growth, roughly divided into three lobes, the central one of which occupied the anterior mediastinum, while one lateral rounded mass occupied the anterior part of each pleural cavity. The heart could not be seen or felt, and neither lung could be seen, but the left lung, soft, shapeless and collapsed, could be palpated behind the left mass of the growth, and the right lung, which felt rather more normal in consistence, though some small hard nodules could be felt in it, was palpable behind the right lobe of the growth. Both lungs were adherent to the posterior aspect of the growth, which was irregularly coloured, dark red, white and yellow, and to palpation felt hard in some areas, moderately soft in others.

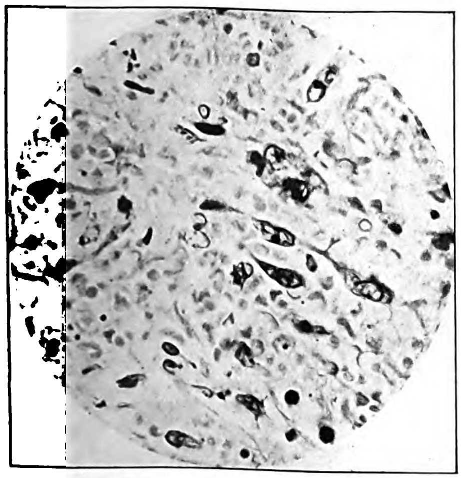
During removal of the thoracic viscera, considerable congestion of the neck muscles was noted, and the muscles were soft and œdematous. There was no enlargement of lymph glands, the mucous membrane of the œsophagus showed no abnormality, and the thoracic duct was healthy in appearance and not distended. The thyroid gland was slightly enlarged, but otherwise healthy. The larynx and trachea appeared normal, but there was considerable inflammation with collection of mucus in the bronchi. The smaller bronchi on both sides contained mucopurulent fluid which, on the left side, was almost like gangrenous material. The mass of the growth was separated from the heart and lungs, and it was found that this could be effected fairly cleanly, there being no actual extension of the growth into any of these structures. The heart was found behind the central mass of the growth, and must have been situated at least two inches from the anterior chest wall.

The pericardium was free from fluid and the heart healthy, though small; it weighed nine ounces. The arch of the aorta was very acute, and showed signs of having been kinked during life, but there was no apparent disease in the wall, and no stretching of the wall could be detected.

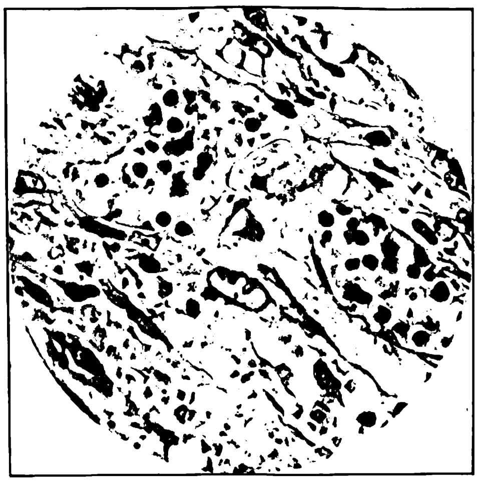
The left lung was brown, shrivelled, shapeless and very soft. It weighed

Small nodule in lung.

Main tumour in mediastinum, showing type of cells.

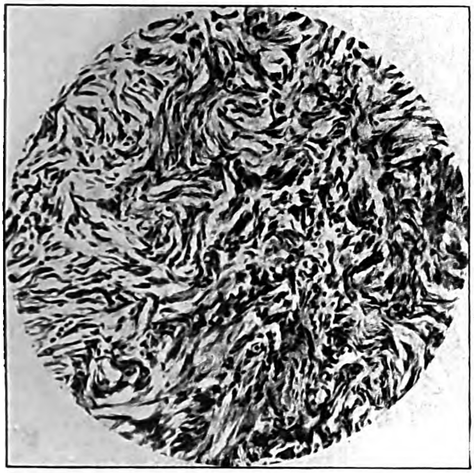


Tumour cells growing among the red cells in a hæmorrhage.



Primitive blood-vessels in main tumour.

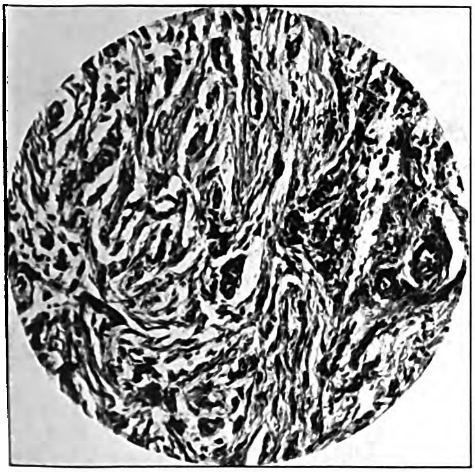
To illustrate Clinical Note, "A Case of Spindle-celled Sarcoma of the Anterior Mediastinum," by Major J. M. Macfie.



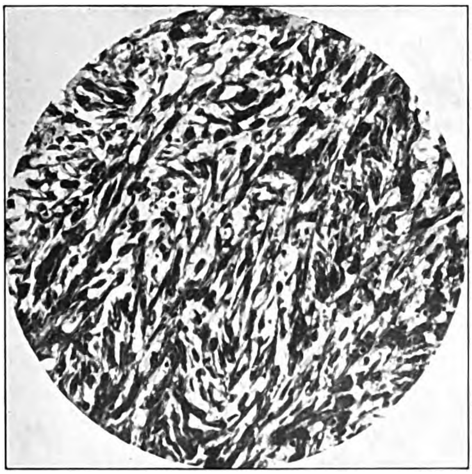
Low power.

High power. Includes a fairly well-formed blood-vessel.

Original tumour removed in 1925.



Recurrent nodule in scar.



Main tumour in mediastinum.

To illustrate Clinical Note, "A Case of Spindle-celled Sarcoma of the Anterior Mediastinum," by Major J. M. Macfie.

twelve ounces. There was no functioning lung tissue present, and it contained numerous round, whitish nodules, up to about half an inch in size. The cut surface of these nodules showed a dull, dense white appearance. The right lung was more normal but showed general congestion. It weighed nineteen ounces and also contained a few round nodules.

One nodule in connection with the left lung was larger than the others and deserves special mention. It measured 1¼ inches in diameter, was situated at the apex of the lung, and was pedunculated apparently under the visceral pleura, so that it had quite a free range of movement. Its cut surface was spotted red and white.

The complete main growth was found to weigh five pounds, and was apparently of anterior mediastinal origin. It was not infiltrative to any extent, but was intimately wrapped round the vessels at the root of the neck. It showed no tendency to erode the chest wall. The cut surface was mottled, red, yellow and white, and showed large areas of hæmorrhagic softening.

Portions of the main growth, of the lungs and liver, a portion of skin from the right shoulder including the old scar, and an enlarged gland from the mesentery were removed for microscopic examination.

The neoplasm was found to be a sarcoma of the large spindle-celled type, the cells fleshy, with large oval nuclei. Nuclear mitoses were not common. Blood-vessels were numerous and badly formed, and hæmorrhages with resultant necrotic softening were scattered throughout. The nodules in the liver, lungs, and in the old scar on the shoulder closely resembled the main growth in structure. The mesenteric gland showed no abnormality.

It was fortunately possible to obtain a slide from the original tumour removed in 1925, and the photomicrographs, here reproduced of this preparation and of sections made at the R.A.M. College from the post-mortem material, were taken by Major J. S. K. Boyd, R.A.M.C.

The similarity between the low power appearances of the tumour removed in 1925 and the mediastinal growth is well shown. The cells of the latter are, however, more irregular in size and shape, and the blood-vessels of a more rudimentary development.

I am indebted to Lieutenant-Colonel G. F. Rugg, R.A.M.C., for permission to write up this case.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS.
Royal Army Medical Corps (*Ret.*).

(*Continued from p. 454, Vol. LV.*)

It would have been difficult to find anywhere a more pleasant and delightful station in which to serve than Allahabad in the years 1883 and 1884. It was the headquarters of the N.W.P. (now United Provinces and Oude) and Sir Alfred Lyall presided over its fortunes. This gifted civilian and Lady Lyall were most popular, and were seconded by a brilliant staff. There was the Secretary, Sir James Millar, who married Miss Lyall, and Sir John Hewitt, later Lieutenant-Governor.

I held medical charge of the 68th Durham Light Infantry for nearly three years, then a long time to be with one corps. It was a very happy time for me, and I recollect my friends of that time very clearly. The officers were all a sporting lot.

Besides the British regiment at Allahabad, there was a Field Battery J/2 R.A., commanded by Major George Gambier. He was a very well-known officer but admittedly a little eccentric. In appearance he was short, stocky and very muscular, and could ride anything from a kangaroo to an ostrich. During the hot weather he had a fall when pig-sticking, luckily saving his neck, but incurring a severe concussion. This made him very irritable and difficult to manage, the only person with the least control over him being his servant, Dan. After some weeks he improved and was convalescent and then was ordered to Mussoorie for a change, but he was still irritable and dangerous to cross. On the evening of his departure he drove with Dan to the station, and proceeded to the luggage office. The train would not be in for some time. Gambier was early as he intended dining at the station before starting on his journey. He called to the Babu clerk to label his luggage. "*Yes, sair, what name?*" "*Major Gambier Royal Artillery*" was the very speedy reply. A long wait ensued, so the Major inquired again, and still no notice was taken. Gambier's gorge rose and he shouted "*Label my luggage at once.*" "*Yes, sair, what name!*" Over the bar went Gambier and seized the culprit's head and synchronized with bangs on the counter the syllables of his name and address. He was at once attended to, ate his dinner and left; but there was a sequel on his return, three months later.

Major Gambier had completely recovered, and on his arrival was immediately presented with a summons for assault. A day was fixed for

the case which would be tried by Major Quinn, the Cantonment Magistrate. This gentleman was a tall, cultured, red-faced Irishman renowned for his skill at cards and games generally. His tastes were æsthetic and literary, with a special leaning towards the humanities. In Court he not infrequently appeared with a copy of Horace, and flirted with Chloe or Lydia whenever he had an opportunity.

On the day of the trial he was seated on a large chair with his legs over the corner of the desk, and a cheroot in his mouth. An attendant waved a fan over him as the sheristadar drawled out the charge. Gambier sat with his legal adviser, and the plaintiff sat opposite with his head swathed in bandages. I was ordered to examine and report then and there on the plaintiff's condition. I found him well, and not a sign of any injury. He wore bandages to show how he looked after the assault. Gambier pleaded irritation and wondered how he had not killed him. He submitted himself to the discretion of the magistrate.

Major Quinn with an expression of great concern laid down his cheroot, and rose to a more erect position. He looked at Major Gambier and at the Babu. Deliberately and with much dignity he said he could find no justification for any British officer assaulting a native in the discharge of his duty, but he did not think Major Gambier would have been there had he been in normal health. The plaintiff had tried to mislead the court by wearing dressings and bandages over the site of supposed injuries. He could not show a single sign of injury. Still he regretted he could not excuse the attack which the defendant frankly admitted but pleaded recent injuries to the head, and these he would take into account. It was clear to him that the clerk did not treat Major Gambier as he should have done. He delayed him and upset him, but that did not clear the offence. Major Gambier was guilty and the majesty of the law of the land must be upheld. Major Gambier was fined one anna.

In 1884 I proceeded on leave to Naini Tal. It was not possible to reach Naini Tal with the comfort and ease of to-day. It was a much more serious undertaking. Arriving at Bareilly I chartered a dak ghari, which consisted of a heavy oblong wooden box on bathing-machine wheels. A shutter-like door opening was on each side, which could be closed up. Across the opening was a thick board at least a foot high which had to be negotiated before entering. The top was flat, for luggage and the servants. A driving seat was in front. There was no upholstery but my bed was laid out on boards. The shandrydan was drawn by two rats of ponies, dressed in bits of leather and rope harness. The wheels were well greased, so when it started it ran along easily. The starting was the difficulty and the wet roads. Luckily the roads were good and the gradients slight. We started about eight o'clock in the evening. I began to read, but this was impossible with the shouting of the driver and the grinding of the machine, so I soon fell asleep and slept soundly. Nothing disturbed me till the middle of the night, when we stopped, and looking out I found myself in a sea of

mud. The road was under repair, which necessitated passing on to the soft track at the side. In front there was another ghari blocking the way, with an officer asleep who had given strict orders that he was not to be awakened. Further, he was a Major and "zubberdast" at that. I reconnoitred the position and decided to use his ponies and help him when I was safe. I soon recovered my position and was on the high road again. I returned to the sleeping Major as I did not like to leave him in the mud; so notwithstanding his injunctions to his servant, I roused him, and all I got for my pains was, "Jhao! Jhao! Haven't I told you not to disturb me?" I made some sort of an appeal to him, but it was not of the slightest use, so I left him and reached Kathgodam four hours later.

We ran up a short incline to a rest bungalow for travellers at the foot of the hill. After breakfast I mounted a pony and commenced to climb the mountain by a good bridle path. The change was delicious as I ascended. In front rose the great mountains, displaying fairy waterfalls and streams racing gaily to the plain. How brightly they sparkled and how sweet the mountain air was. Dark green woods with the road winding to Bhim Tal were on my right, and a scarped hill on my left. At every turn of the road there was superb scenery till I reached the base of the last climb into Naini Tal. This was a beautiful spot. Lovely flowers abounded. Hidden among the trees and luxuriant vegetation was a house and garden overlooking the torrent from the hill, where I procured some strawberries and cream served in the most English manner by Mrs. Martin, the wife of an Hon. Officer of the P.W.D. These good people had incurred a deep sorrow in losing a son here from drowning. They could not forsake the place so settled down and made it beautiful, calling it Douglas Dale, after their boy, Douglas.

The last climb to Naini Tal is very steep, and the beautiful station discloses itself suddenly. It was a glorious picture that afternoon, rather Swiss in character, the whole being bathed in a blue colour. At the opposite end of the calm lake Cheena mountain towered to the sky, while at its foot was the bazaar with various coloured houses set in the dark green of forest trees. The lake reflected the exquisite shadows. It was enchanting and a dream picture of Paradise.

Riding along the northern side of the lake I reached the Mayo Hotel which would be my home for a few weeks. My rooms looked through a screen of trees on to the cool lake. At dinner I sat next to Dr. Tyler (afterwards Sir John). He was the Superintendent of the Agra Jail and a well-known officer of the Uncovenanted branch of Public Service. He was a clever man and brought the system of prison management to a high pitch of efficiency. He also obtained a world-wide reputation for carpets made by the prisoners, and he sold one to Queen Victoria. He was closely connected with India and by his magnificent air and *bonhomie* suggested the Mogul age. Major and Mrs. Palmer were there. He was afterwards Commander-in-Chief.

The barracks were at the lower end of the lake facing the ravines which led to the plains. One stormy night when Durga was on the rampage, young Cummins of the Canadians was riding round the guards when he fell with his horse over the precipice. Nothing could be done that night, though every effort was made, but the next morning he was found far down the rocks dead, and his horse beyond him. This threw a gloom over Naini Tal for some days.

There was a flourishing amateur dramatic club, chiefly managed by Major Barrington Foote, of the Royal Regiment. He was an incomparable actor, and possessed a beautiful voice. I played Bouncer in the operetta of *Box and Cox* with him and Gordon of the same regiment, and we made a lot of money for one of Lady Lyall's charities.

In September I was ordered to rejoin at once for cholera duty, and left immediately. My tedious journey up by road was now rendered unnecessary by the opening of a railway, but as I was starting it was reported that the bank had been broached by floods in many places. I was in a quandary, as I hardly knew how to get over the sixty-three miles to Bareilly, but hoping for the best, I determined to push on and see what had happened.

Full of health and spirits I ran down the hill and in an hour my worst fears were realized. There was no communication of any kind, and I was fairly and squarely marooned at Kathgodam. My orders were urgent and imperative, so nothing must prevent me from reaching the regiment. I hired a pony and bought a trap in which I put my luggage and servant, and drove off. It was a funny contrivance, but we started well at about 5 p.m. with thirty miles of the Terai to cross while there was light. After negotiating eleven or twelve miles, the pony began to fail, so we got out in turns and led him. How lonely it was in the jungle alive with wild cats, though we saw none, but my servant was scared. By hook or by crook I must reach Baheri, half-way to Bareilly.

Darkness suddenly overtook us at about 9 p.m., so we lighted the lantern and helped the pony, but we were becoming tired and exhausted. Slowly we trudged on for three more weary hours. My man was in the cart, and I led the pony, which stopped every few yards. We reached the bungalow at last, and after midnight. All was still and there seemed to be no signs of life. I released the pony which fell down exhausted. My bearer found the khansama of the rest house, who, affecting surprise at our arrival, told us that he had nothing to give us, as no one ever stayed at his place. I quickly undeceived him, and eventually he cooked some eggs and made some native cakes. I then asked him for something to drink, and examined his store. There was not much, but on a lower shelf I espied a row of Bass's India ale smothered in cobwebs and dust. I asked him how long it had been there, and he replied, "Twelve years." One was opened and I never tasted such nectar in all my life, so I opened a second and perhaps a third, which, with the eggs, made a glorious meal. How I

got into bed I do not know, but I slept well and woke early and went to see my pony and gave him a bottle of beer with his feed. I bought the remainder of the beer and put it in the cart. There had been more rain, but the sun was shining brightly, and it was hot. I was warned that the road was flooded in front, but was not deterred and started off gaily. It was not long before we reached the flooded place, and had to pass through a foot of water for some distance. It was heavy going, but my pony was working very well. The water seemed endless, and I began to be seriously anxious, but determined to go on and, if the worst came, to seek refuge in a tree. Luckily, it never attained so serious a stage, but we were getting worn out. We reached a spot where it was possible to leave the water and rest on a little higher ground Here we had some food and I gave the pony another bottle of beer, but I dared not drink it in the heat. I did not like the idea of entering the flood again so waited till some natives passed, who told me that six miles ahead men were working on the railway, and the road was almost impassable at one place. I decided to go on, and got along very well till we reached a place where the water was getting deeper and nearly up to the axle-box, with a current crossing the road. Fortunately this part of the road proved quite easy, and we soon breathed freely on the other side of the flood. A short distance further on I saw the engine and heard that the road was clear into Bareilly. My servant went on by road and I got a lift on the engine. At Bareilly I went to the dak bunalow and found it was full. The khansama advised me to call on Mr. Bullock the Commissioner. I went there and found he had not returned from Naini Tal. His servant told me that Mr. Bullock would be angry if I went away, so I stayed. I fell asleep and waited for my trap which turned up later.

I had a friend named Montresor in Naini, but of whom I have heard nothing since, and I decided to ask myself to dinner at his Mess, the 5th Bengal Cavalry. Putting on my kit I strolled to the Mess and waited in the verandah in the hope of waylaying my friend. In a few moments Colonel Shakespeare arrived. I saluted him, and he inquired who I was and told me that Montresor had not returned. He then asked me to be his guest. Under the genial influence of a kind host and some "bubbly" I rapidly recovered, and bidding the Colonel "Good-night," returned to Bullock's house. I was very tired and the "bubbly" had done its work. Reaching the verandah I saw my servant stretched out in a deep sleep, so I pulled off my jacket and fell on to the bed. I remembered nothing more, and must have slept well.

About 5 a.m. I awakened and found myself in a strange bed, booted and spurred, with my mess jacket on the carpet. I looked round and saw furniture no military man ever had in those days, including pictures and carpet. What had happened? Listening, I heard voices in the verandah, so I walked out and found Bullock and a friend having chota hazri. Then the truth dawned on me. I had slept in Bullock's bed and he in mine.

I made the best amends I could, but he passed it all off, saying, "I hadn't the heart to wake you up after hearing of your trials marching down." He kept me till the evening mail, which I entered and continued my journey. I am deeply grateful to this day to Mr. Bullock for the sleep I had in his bed.

Reaching Allahabad without any further incident, I found the 68th were in camp at Bargarh. Major Lee commanded, and Carleton, Hilliard Park, Mansel, and Granville Wells were with the regiment, and I think De Lisle either joined us in camp or soon after. Some men died from cholera at Allahabad, but after our arrival in camp we were free. We occupied a site on a raised part of downland near the jungle track leading to Bargarh village, while below was a jheel with a mighty peepul tree growing magnificently on its bank. The camp was very hot in the day, but towards evening became pleasant. We shot small game, went for rides, and amused ourselves till dinner time. It was here I first tasted roast bustard, and enjoyed it more than any bird I have ever eaten. There are two kinds of bustard, the greater and the lesser, and our bird was of the latter class. When disturbed these birds run at a great rate over the plain, then lie flat and become very indistinct; the colouring of their surroundings is so like their own that it is difficult to see them. They must be stalked warily and shot with a small rifle. Titur, grouse, quail, and wild duck were plentiful, the last having just returned from Central Asia on the advent of the cold weather. We shot the ordinary grey partridge, and sometimes the black partridge, a most delicious table bird. These birds roost in the large bushes and do not remain on the earth as in England, and I remember how surprised I was when I shot my first partridge as it flew out of a bush a few feet above the ground. There was a grouse called the Imperial grouse, but I think we were incorrect in so naming it, for such a bird could only be the "capercailzie," chieftain of the cock tribe. We obtained red and sand grouse occasionally. Quail were plentiful, and were beautifully cooked for us, each bird carrying a green chilli in his beak to enhance the flavour of his body. I do not eat quail at home, as I hear that mice make very good substitutes and prefer to dwell on my former experience. Teal and wild duck with an occasional goose were sometimes in the bag. It was a fine sight watching thousands of geese, led at the point of an angle by some king goose, pass across the sky.

The days were pleasant in camp. One morning a sahib in "civies" walked through our camp, and we wondered who he was. At breakfast this wanderer filled up the tent door, saluting us with a gentle voice and in a polished manner. Immediately disarmed, we begged him to come in. He was most interesting and told us many stories of India. He was no less a personage than General Cunningham, C.I.E., head of the Archæological Survey of India, who performed monumental work in this branch, wrote volumes of notes, and collected much interesting matter. I believe he had the misfortune to lose many of his specimens and books in the ill-fated "Roumania."

We returned from camp to Allahabad, and a few days later I was detailed for duty at the Delhi Camp of Exercise. This camp was organized on a very large scale, and mimic war was carried on between Amballa and Delhi, the Northern force marching from Amballa under Sir George Greaves, and the Southern Force from Delhi under Sir Charles Gough.

I was attached to a British Field Hospital of the 2nd Division of the Southern Army, and in addition was Staff Surgeon to General Sir Charles Gough, V.C. I was delighted with the prospect, as I was going to be initiated into the art of war for the first time. I arrived at Delhi with a small kit, a pony and Wolseley's Pocket Book. I loved this book, and I freely acknowledge that it has been of the greatest possible use to me, as I was never at a loss in any common military exercise or duty. Troops were arriving from all parts, and marching gaily out to their camps with their bands playing.

I went to the dak bungalow to clean up and report myself to the P.M.O. and walked out into the compound, where many horses were tethered. I noticed a nice looking man of about fifty years petting two beautiful Arabs. I saluted him as I could see he was a senior officer. He was most gracious and kind, and asked me where I had come from, and when I told him that I was on my way to find the P.M.O., remarked, "I am the P.M.O." I went with him to his office and he said that his secretary had not arrived. I immediately volunteered to work for him. "So you shall, my dear boy." I am a Welshman, and what I would have done for Surgeon General George Farrell, I.M.S., for it was he, is not to be measured. "Have you a note-book?" he asked. I not only had a note-book but a celebrated Pocket Book. I could have told him the times of the moon tides, where they existed, and indented fairly correctly for food for all the troops and horses in the camp. "Yes, sir, I have a note-book." "Can you ride?" "Yes, sir." "Take my horse and this letter to Surgeon-Major Malley at the Kutub." The distance was about four miles, and I was on a most perfect charger. My Celtic blood was up, and I was soon back, but when the Surgeon General saw his horse in a lather, he said with a smile, "Take it quietly, Morris." I exercised both of his horses, and what beautiful rides I had.

It was at this Camp of Exercise that I became interested in ambulance transport, and in which later I was privileged to do some work. I remember the first incident that impressed me. One morning some remarkable looking crates arrived to be tested for the carriage of sick and wounded. They were designed to take the place of the camel kajawah, and were adapted for sitting up or lying down. In order to test them five young camels were sent to the hospital. These seemed untrained and excitable, but we put the crates on them and some khalasies volunteered to ride in them. We got the camels up, and then occurred a scene I shall never forget, as these creatures got rid of their loads. One camel got a crate twisted round and underneath him and started a wild career down

the maidan close to a Division of Artillery. This beast sprang in the air for some feet, and then in a spread-eagle fashion came to earth. All this went on within a short distance of the horses; they had never seen such a sight, and were pulling on their shackles. Eventually the camel was upset in a reen, and only his legs could be seen waving in the air. The khalasies were all thrown out, but escaped without injury. The crates were returned into store and the time-honoured kajawah retained its supremacy.

For the first ten days we were engaged in inter-divisional manœuvres, and I was beginning to think no small things about myself, for I was running everything. However, I was riding for a fall, and one morning I was in bed at 8 a.m. when I should have been up. I heard horses' hoofs outside, and a Staff Officer put his head into the tent and said, "Morris, the General would like to speak to you." When I got out the G.O.C. blandly remarked, "It is very quiet here this morning," and asked me to examine his eye at 11 o'clock. I then went over to my Chief, who remarked, "Has he gone?" and being reassured, he repeated, "Gone right off." "Yes, sir," I replied. "Then I think I will rest a little," fell back and slumbered. I saw the G.O.C. later, but he made no further remark, at which I was relieved.

The time was approaching when the two forces would leave their bases and march to battle somewhere between Amballa and Delhi. Sir Frederick Roberts, having relieved Sir Donald Stewart of the post of C. in C., had arrived in camp and paid us a visit, and well I remember his charm of manner. It was my fortune to know him later, and a good friend he could be. At last we marched on, and shortly after starting I was overtaking a string of camels on the bank of a canal, when one turned round and gurgled in my pony's face. He was scared and shied, with me on his back, into the canal. I was helped out and dried in the sun, but it was an unpleasant experience. Later I met the P.M.O. who, notwithstanding my dishevelled appearance, told me to ride away to the first camp as there was some difficulty with the drinking water. I soon got there, and met Major Kelly (Kelly of Chitral), who was Q.M.G., and inquired about the water, and he invited me to see it for myself. It looked all right, but when shaken in a bottle emitted an appalling odour. Here was an impasse, with 20,000 men approaching. I examined the stream but found nothing, so determined to ride up stream, and had not gone far when I saw vultures flying in my direction towards the earth, and riding further found them devouring a dead camel in the stream. A pack water transport was soon organized from a point above the carcase till an aqueduct could be made by the engineers. After this shock I was glad to find my tent and have a bath.

A day or two later we were feeling for the enemy, and met him finally in a pitched battle on the celebrated plain of Paniput. Some of the greatest battles in Indian history were fought here. During the fight two Irish regiments met and tried hard to have a fight, but luckily Sir

Frederick was near, and with his usual tact executed some movement which eased the situation. We lost this battle and retreated on Delhi, making a final stand at Badli-ki-Serai, which was decided in our favour, and the cease fire blew ending the active part of the training. The combined forces then marched on to the Ridge for a rest and a ceremonial parade before the Viceroy.

The Durbar of 1885-86 was a superb event. The Viceroy, Lord Dufferin, and the Commander-in-Chief occupied a number of Durbar tents at the end of a long street between rows of tents, reserved for all the great officers of State and their staffs. Foreign officers from every nation were present, and the most beautiful and distinguished ladies were in camp. Each tent was surrounded with flowers, and cress sown in the sand to hide the dust and make a cool green colour against the white tents. The Indian Princes' camps were near and very splendid. The most costly purdahs and carpets adorned them, and the tent poles were covered with gold lac. The effect was enhanced by the marvellous variety in the uniform of the attendants and the magnificent trappings of huge elephants, with their cloths from the corners of which hung golden bells. The richly-caparisoned horses also lent gaiety to the scene. I was greatly impressed by the sights and never more so than on the Sunday evening in the camp, when a tattoo was played by the massed bands. It was an unforgettable event. The moon was shining brightly as the Staff Officers with their guests in gorgeous uniforms, and ladies in the most magnificent dresses, were parading up and down the lawns, while the most scrupulous form and dignity was preserved, which helped to make a thrilling picture. Away on the celebrated Ridge stood the Flagstaff Tower, about a mile from the Viceroy's tent. What must have been the feelings of many like Sir Frederick, who knew the former terrors of that place? It was entrancing. Suddenly the massed bands struck up, and opened the programme with the "Silver Trumpets" and "The Harmony in the Dome." The time and effect were thrilling. Then followed "The March of the Priests," Sullivan's "Lost Chord," "National Airs," "Abide with me," "Glory to Thee my God this night," "God bless the Prince of Wales," and terminated with "God save the Queen," in which every voice in the camp must have joined. Never have I enjoyed such a feast of music.

The following day was January 19th, 1886. It broke wet and dismal in the extreme, but the march took place before Lord Dufferin, who saw it all through and would not wear an overcoat because the troops had paraded without them. The march was through a sea of mud, but was carried out without a hitch. I remember that many Indian soldiers lost their shoes by these sticking in the mud, but they were not deterred, and gaily went on without any footwear sooner than disarrange their line and order. This led to their being supplied with ammunition boots by the State.

I called the next morning on the P.M.O. and found his secretary had

returned to Lucknow. He was overwhelmed with papers, so I volunteered again to stay and help him, and never have I had cause to regret that little thoughtfulness for my Chief. In a few days all was finished and I saw him off to Abbottabad, and left for Dinapore.

Once more the scene changed and I found myself in the old station of Dinapore, on the bank of the Sone river, where it enters the Ganges. In the rains the Ganges becomes a noble stretch of water, and few are aware that Pataliputra, the great capital of Chandragupta, lies buried under its sands. The King's Own Light Infantry was stationed here under the command of Colonel Burnaby. Major "Spot" White was second in command, and there were Earle, Elles, Marrable and others. This was a splendid regiment, and my eldest son later became an officer in it.

I was in medical charge of a Field Battery commanded by Major De Horsey Curtis, with Dunlop, Tyrrwhit, Duffus and Singer. It was with this battery that I marched to Dinapore.

The hospital at Dinapore was a very old-fashioned one, and was controlled by Surgeon-Major R. N. Macpherson, and the other officers were Alfred Keogh, Shaughnessy and myself. Macpherson was a charming man who liked things done with as little difficulty as possible—but decorously and well. I do not think our Chief was responsible for the colour of the building, which was an ugly blue and looked very odd.

We little suspected that our senior surgeon was later to be the distinguished Director-General Sir Alfred Keogh, G.C.B.

The regiment at Dinapore supplied a detachment to Chunar Fort, and in the middle of the hot weather I was ordered there. I was sorry to leave, but at the same time new scenes appealed to me, and in three days time I was taking over from F. J. Lambkin, one of the pioneers of the improved treatment of venereal disease.

Chunar, popularly known as Chunar Ghur, was an old Mogul Fort on the right bank of the Ganges, and ten miles above the ancient Kasi, now Benares. The house detailed for me was palatial, and was once occupied by Warren Hastings at a critical period of his reign. This house was built in a park-like enclosure, full of large spreading trees. In front from a large balcony there was a fine view of the Ganges flowing east, below was Sultanpore on the road from Benares to Allahabad, while to the right stood Chunar church. The civil part lay behind the fort on the river bank, and on the east stood the barracks of the Invalid Battalion.

The outstanding feature of Chunar was the Invalid Battalion, long since disbanded by death.

Many old soldiers lived in India after the Sikh Wars and settled down in various parts of the country after marriage, in many cases with natives or half-caste women. The result of these unions is the considerable Eurasian population of the present day. When the Mutiny broke out these pensioners were called to the colours, and were generally placed on garrison duties which would not require the exertion of service in the field,

though many faced this. They were a brave and gallant company. After the Mutiny these men were placed on full pay for life and arranged in Invalid Battalions. They only held one parade a month, which was the Muster Parade, and as they received rations and clothes in addition to their pay, were well off, happy and contented. I attended two Muster Parades, and intensely interesting they were. These gallant men looked as "spic and span" as Guards, and made a wonderful picture with their different uniforms. The uniform of the Bengal Artillery has never been surpassed.

One hot day in June, 1886, I was suddenly summoned to attend John Turner, an invalid pensioner who had set himself on fire when smoking in his bed. I hastened down and found him a stoic under pain, and gave the usual treatment for a very extensive burn on the leg. Turner was 86 years old, and a week before he died he told me his story. He was born with the century in Liverpool, and lived with his parents near the docks of that town. He did not recollect his father, and only indistinctly being drawn along very fast by a woman with his head muffled up in her dress. At the age of seven years he was apprenticed to a cotton spinner, and at ten was "shanghaied" for the Royal Navy by a press gang. He was shipped away and found himself on H.M.S. "Asia," bound for the West Indies and the Pacific. Five years later he sailed once more into Plymouth Roads and passed close to the "Bellerophon," and was able to see the Emperor Napoleon who had recently surrendered to the English. After a short stay he sailed for the Coromandel coast and completed his twenty-one years service on the Indian Command. He took his discharge at Madras in 1830. His fortune was one shilling a day. Full of pluck and enterprise he started to shake the legendary pagoda tree and become rich. He was soon disillusioned and quickly returned to Madras and enlisted in a John Company regiment. He fought in all the wars of the time, including the Sikh Campaign and, having completed twenty-one years in the Army, retired. His fortune now was one shilling a day from the Navy and a shilling a day, from the Army, two shillings in all. He married a lady of the country, and settled down as church clerk at the mission station of Buxar, and reared a family. He was called up on the outbreak of the Mutiny and served in the Allahabad Fort, and finally became an Invalid Pensioner at Chunar. A few years later his wife died, but the gallant old man kept his head up and smoked his pipe and faced many family difficulties stoutly.

Poor Turner began to lose ground, though I was very sanguine that I would pull him round. I visited him frequently every day, and once I said, "Turner, would you like a couple of bottles of Bass?" "No, Sir," he replied, "a quart of canteen beer will do me good, Sir, for do you know the cheaper the beer, the better it is." He slowly became worse, but there still remained the question of amputation. I explained to him the position, for so healthy was he at 86 that I felt there was a chance of his weathering the shock of operation. However, Turner decided for himself, and said to me

"For eighty-six years these legs have served me well, and I will live or die with them." A day or two later he quietly died. Mr. Carruthers was the Chaplain, and as he was away it fell to my lot to read the burial service. It was a romantic and a sad duty to perform on that hot evening in the celebrated old station of Chunar. A firing party was sent from the detachment, and his old comrades were present and acted as pall-bearers. One of them was Sergeant Shanahan, who at the battle of Onao, as Havelock advanced towards Lucknow, trained his gun on a rebel cannon that was doing much damage to the British line and pitched it off its limber and rendered it useless. The British advanced and the battle was won. The second was a Bengal artilleryman, whose name I forget; in full dress, braced and nerved for the occasion, he marched boldly along. He was Hodson's favourite orderly and was with him at many of his exploits, including the shooting of the rebel princes, and was the first beside his master when that brave leader was shot on the taking of Lucknow. The third was Trumpeter Lesturgeon, who was on duty with Sir Colin, and was the first bugler to sound the advance on Lucknow. In 1886, on the Queen's birthday, I gave a little entertainment to these men, and I told Lesturgeon to blow the advance "as you did before Lucknow." He did it, and it was a moment to live in as his comrades stood stock still and afterwards slowly, and in a most dignified manner, touched their caps to the memory of those thrilling days of daring and chivalry.

The Burmese War had been going on for some time when it was decided to reinforce the troops; I noticed Surgeon-General Farrell had been appointed P.M.O., and almost at the same time I received a letter from Surgeon-General Madden, P.M.O. India, telling me that I had been asked for by Dr. Farrell to be his Secretary. He wrote that he had considered the matter very carefully and had decided that I was too junior for such a position, but that he would send me to Burma, and Dr. Farrell could do what he liked with me, but Surgeon-Major J. D. Edge would be Secretary.

A few days later I left for Burma.

(To be continued.)

Current Literature.

DUDGEON, L. S., & GOADBY, H. K. **Further Observations on the Staphylococci, with Special Reference to their Hæmolysins and Variability.** *J. Hygiene.* 1930, v. 30, 180-95, 1 chart & 4 figs. on 1 pl. [11 refs.] [St. Thomas's Hosp., London.]

The authors have carried out a considerable series of experiments on the immunological reactions of the pyogenic staphylococci. From their results they draw the following conclusions :—

Although rabbits readily produce agglutinins and precipitins in response to the inoculation of *Staph. aureus*, it has not been possible to establish an efficient protective immunity. The intravenous injection of colloidal silver, synchronously with living *Staph. aureus*, does not significantly alter the subsequent course of the infection. A small amount of calcium chloride, injected with living *Staph. aureus*, does not modify the local or general lesions. Intradermal injection of live *Staph. aureus* results in the formation of agglutinins. Rabbits fed on *Staph. aureus* develop specific antibodies and show evidence of a generalized infection. In a rabbit which is resisting a *Staph. aureus* infection, the platelet count remains normal. When this resistance is broken down by a fatal infection the platelet count may rise to 2-3 times its normal value.

All hæmolytic strains of Staphylococci give rise to non-hæmolytic variants. The non-hæmolytic variants differ from the hæmolytic strains in diminished pathogenicity, lessened pigment production and slower liquefaction of gelatin. The non-hæmolytic strains also show a greater tendency to auto-agglutination.

Normal human sera often agglutinate a live suspension of *Staph. aureus* to low titre. The sera of patients during severe *Staph. aureus* infections, or of a person convalescent from such infections, have not shown any increased power of agglutination, either for their own or other strains.

Absorption tests have not shown any advantage over direct agglutination, in determining serological grouping among strains of *Staph. aureus.*

W. W. C. TOPLEY.

Reprinted from " Bulletin of Hygiene," Vol. 5, No. 11.

DOWNIE, A. W. **Experimental Streptococcal Infection and Immunity.** *J. Path. and Bact.* 1930, v. 33, 563-606, 3 charts & 6 figs. on 1 pl. [74 refs.] [Dept. of Bact. & Preventive Med., Univ. Manchester.]

The author has carried out a large series of experiments dealing with immunity to streptococcal infections in the rabbit. Among the more important of the conclusions which he draws from his results are the following.

Immunization of rabbits with toxin from the Dochez strain of scarlatinal streptococcus protected rabbits against the acute effects and death following intravenous or intradermal injection of this strain, but not against localized infections in the joints. A similar degree of protection against the Dick scarlatinal strain was observed; but there was no evidence of protection against highly virulent strains from other sources, irrespective of their power to produce toxin *in vivo* as estimated by skin tests. Immunization of rabbits with the washed heat-killed streptococci of the Dochez strain did not give protection against infection with the homologous strain. The sera of rabbits immunized with the toxin or heat-killed streptococci of the Dochez strain did not protect mice against infection with the homologous or heterologous strains used; nor was antitoxin demonstrated, by the methods employed, in the sera of the rabbits repeatedly injected with toxin.

Immunization of rabbits with the toxin of a highly virulent strain (Davis) did not protect these animals against infection with the homologous strain, nor with other highly virulent strains, but did afford some degree of protection against the less virulent Dochez strain. No passive protection of mice against any of the strains used could be demonstrated with the sera of these rabbits. Repeated injection of rabbits with washed, heat-killed cocci of the virulent Davis strain protected them against fatal infection with the homologous strain, but not against the moderately virulent Dochez strain. The sera of these rabbits protected mice against infection with the homologous strain, but not against the other strains tested, a fact which suggests that the immunity was type-specific.

It would seem that with the highly toxigenic, moderately virulent strains immunity is antitoxic rather than antibacterial: with highly virulent strains, however, effective immunity would appear to be antibacterial, and hence type-specific, rather than antitoxic.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

Smith, J., & Scott, W. M. **Continued Fever due to a Gaertner-like** *Salmonella* **of the Type "Dublin."** *J. Hygiene.* 1930, v. 30, 32-9, 2 charts. [6 refs.]. [City Hosp. Lab., Aberdeen, & Path. Lab., Ministry of Labour, London].

The authors record three cases of continued fever in man due to the recently described "Dublin" type of Salmonella bacillus. The organism closely resembles *Bact. enteritidis* (Gaertner) in its antigenic structure, but can be differentiated from it by adequate absorption tests. Its detailed antigenic structure has recently been described by Bruce White. (See this *Bulletin*, 1930, v. 5, 402). It has the ordinary fermentation reactions of the Salmonella group, but can be differentiated from *Bact. enteritidis*, and from many other Salmonellas, by its failure to attack arabinose.

The authors set out, in Table II, a comparative series of fermentation reactions.

TABLE II.

	Monosaccharides						
	Hexoses				Pentoses		Methyl-pentose Rhamnose
	Dextrose	Lævulose	Galactose	Mannose	Arabinose	Xylose	
Fermentation tests:—							
A. Enteritidis (34 strains) ..	A.G.	A.G.	A.G.	A.G.	**A.(G.)**	A.G.	A.G.
B. "Dublin" (15 strains) ..	A G.	A.G.	A.G.	A.G.	**O.**	A.G.	**A.G.** (late)

	Disaccharides			Trisaccharide	Polysaccharides		Alcohols		Glucosides	
	Maltose	Lactose	Saccharose	Raffinose	Dextrin	Inulin	Mannite	Dulcite	Salicin	Inosite
Fermentation Tests:—										
A. Enteritidis (34 strains) ..	A G.	0	0	0	0	0	A.G.	A.G.	0	0
B. "Dublin" (15 strains) ..	A.G.	0	0	0	0	0	A.G.	A.G.	0	0

	Indol production	Sulphide production (lead acetate broth)	Litmus milk
A. Enteritidis (34 strains)	0	Black	Alkaline
B. "Dublin" (15 strains)	0	Black	Alkaline

The authors suggest that many of those cases which have in the past been regarded as instances of continued fever due to infection with *Bact. enteritidis* were in fact caused by infection with *Bact. dublin.* The suspicion that the Dublin type may be specially associated with the bovine species, and that the milk is the usual source of human infection, is supported by: (1) the fact that it is apparently the cause of the common epizoötic dysentery among calves; and by (2) that in the majority of the cases, in which it has been isolated from man, milk can be definitely suspected.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 11.

Penfold, W. J., and Parker, G. **Active Immunity against *Bacillus œdematiens*, with special reference to Black Disease of Sheep and the possibility of the Prevention of Gas Gangrene in Man.** *Med. Journ. of Australia.* 1930. Vol. II, No. 18, 601-6.

Black disease is one of the more important diseases which affect sheep in Australia. In common with other workers the authors have found *B. œdematiens* present in the necrotic areas of the liver. The organism was most easily isolated from ailing sheep which were killed. Methods of obtaining pure cultures are described. This organism is also of great importance in human pathology as one of the three organisms most frequently associated with gas gangrene. For the preparation of vaccine a clear filtrate from peptic digest broth was obtained by filtration through ordinary filter paper. This was adjusted to pH 8·2; 0·3 per cent of formalin was added and the mixture incubated at 37° C. until it was non-toxic to guinea-pigs in doses of 5 c.cm. This usually took about seven days. This product is of the nature of an anatoxin. Twelve guinea-pigs inoculated with 2 c.cm. of this anatoxin were all protected against certainly fatal doses of the culture. Nine sheep inoculated with varying doses of anatoxin were all protected, while seven controls all succumbed to the test doses of culture. The authors conclude that an efficient active immunity in guinea-pigs and sheep can be produced by a single dose of the vaccine described and recommend its trial on monkeys with a view to its application to man. C. J. C.

Reviews.

Recent Advances in Preventive Medicine. By J. F. C. Haslam, M.C., M.D.(Edin.), M.R.C.P.(Edin.), D.P.H. London: J. and A. Churchill. 1930. Pp. vii × 328. Price 12s. 6d. net.

The author has collected from a large and ubiquitous mass of literature some extremely interesting and instructive information which cannot be found in the average textbook on Hygiene.

He starts with a chapter on eugenics in accordance with the now generally accepted truth that to have a sane and healthy race you must breed from healthy stock only. What should happen to the mentally deficient and the diseased is discussed in a practical manner.

Then having selected his healthy parents he investigates the risks to mother and child during the pre-natal, natal, and post-natal stages, and suggests that as regards puerperal sepsis, a rock against which our preventive measures break in vain, midwives should take the place of practitioners in conducting normal labours, as it has been proved that there is less chance of sepsis occurring when there is no instrumental interference, an operation forced on the doctor very often because he cannot spare the time to attend throughout normal labour.

The hygienic life of the infant and school child is next studied and a comparison is made between the condition of the poor at the present day and thirty years ago, very graphically emphasized by photographs of a class at the same school then and now.

Milk, the natural food of children, has a chapter to itself.

The author discusses first the advantages of the "growth" qualities of milk, both whole and skimmed, over any other food, then he criticizes the Public Health Laws, as regards chemical standards, pointing out the great variation there may be in the milk fat content, compared with that of the water, and agrees that a water standard would be fairer to the dealer. He points out the lowering of the soluble calcium in the milk, resulting from pasteurization and the effect of this want in the nourishment of young animals, and finishes the chapter with a well-argued criticism of the milk (Special Designations) Order, 1923.

He rightly agrees there ought to be a standard of purity for the present ungraded market milk as it comprises 1,000 times the supply of the graded milk, and points out that as the cost of graded milk is prohibitive to the poor, the child that requires a good milk most is the one who does not get it. He supports the suggestion that sound market milk should be called Standard milk, and the present certified grades, Special Standard, and Super Standard.

Vitamins are dealt with by S. J. Cowell, M.A., M.B., M.R.C.P., and the very latest work is recorded in an easy and interesting manner.

Next comes Leonard Hill's work on the Katathermometer, with a great deal of formulæ and mathematics, and then Industrial Hygiene with "Safety First" as the slogan, more especially with reference to accidents.

Finally, immunization against diphtheria and scarlet fever is treated at a considerable length; with regard to the former, Dudley's work on the Schick test is given prominence.

The book is of immense value to the student who wishes to study hygiene beyond the covers of the ordinary textbook, and he is assured of some very interesting reading, and given suggestions along those lines on which modern investigation and study should proceed.

WHAT WE DRINK. By various authors, with an introduction by Sir James Crichton Browne, F.R.S. 1930. London: W. Heinemann, 1930. Pp. xiii × 128. Price 1s.

This claims to be a scientific treatise on the various drinks obtainable in the English market, published by the True Temperance Association, presumably for the edification of the mass, for it appears in a popular edition.

The general impression given to the reader is that the authors have with malice aforethought set themselves out to malign their particular drink to the utmost of their ability.

One has only to read the dreadful sequence of events, physical deteriora-

tion, mental depravity induced in those whose only vice has been to look upon tea or coffee when it was hot to realize what risks we take, or to hear the tale of woe from the author on milk, who, like many others, appears to see in this perfect food merely a solution of vitamins contesting for supremacy with a culture of virulent organisms, to make one overflow with gratitude at having reached man's estate unstunted and in comparatively good health. Incidentally, this author is not altogether clear as to what is meant by pasteurized and sterilized milk.

The preparation, chemistry, and effects of the spirits are dealt with, and here again, we look in vain for some cheerful and comforting words, but the Association condemns all varieties ruthlessly, unless they are taken freely diluted and with the greatest moderation.

One might think that the merits of water would be extolled with a little enthusiasm, but hardly has the chapter commenced, before a whole list of blood-curdling water-borne diseases is paraded, that would frighten the stoutest hearts.

The allowance of one bottle of wine a day for an active individual, as ecommended by the wine expert, is quite a liberal one, and yet he precedes this admission with many words of warning.

Carbonated waters, or soft drinks, add to the list of beverages studied, and the author of this chapter is a keen advocator of them, pointing out how much the U.S.A. has benefited. The only harmful effect he can produce is that caused by drinking large amounts of these drinks iced which might just as well happen with any other kind of drink.!

H. Wansey Bayly, who writes on beer, is a man after our own heart; his remark, "Not for nothing has beer become associated with jollity, good humour, and sympathetic generosity," is an example of the cheerful strain that pervades the whole chapter, though perhaps exception might be taken by certain Scots to his, "While we are apt to picture the whisky drinker as a thin, melancholy individual, inclined to meanness."

He advocates taxing beer according to its alcoholic content, and assures us, although it doesn't somehow fit in with our experiences in the war, where beri-beri was equally common amongst beer and non-beer drinkers, that "Vitamin B is present in beer in a useful quantity," but then was it beer we drank?

So let us all heed what the book teaches us and take no risks, but once again make good English and Scottish ale our national drink.

A Study of the Strategy and Tactics of the Shenandoah Valley Campaign, 1861-1862. With six maps. By Lieutenant-Colonel A. Kearsey, D.S.O., O.B.E., *p.s.c.* Aldershot: Gale and Polden, Ltd. 3s. net.

In a handy paper-covered book of seventy pages the author gives a short study of the strategy and tactics of the Shenandoah Valley Campaign. He cleverly illustrates some fundamental principle of war in each battle

which he describes. In the first chapter he gives a general summary of the war, and shows how in it the necessity for mobility was brought out and how this mobility, in spite of inferior numbers, was the basis of the success of the Confederates in the early years. He lays particular stress on the principle that mobility will always win wars and that the chief lesson to be applied to-day must be the improvement of the mobility of our army before anything else.

If in the next two decades we can train our forces to be mechanically mobile and to realize the necessity for altered conditions, he says, we shall not have to fear the result. The second chapter is a diary of the events of the war. In Chapter III the author shows how the principles of war are illustrated throughout the campaign, and then follows a chapter commenting on the different battles. There are six very clear maps. In spite of being much condensed the book is very readable and should be of particular value to those preparing for promotion examinations.

A. Ç. H. G.

SICK CHILDREN: DIAGNOSIS AND TREATMENT. A manual for Students and Practitioners. By Donald Paterson, M.D., F.R.C.P. London: Cassell and Co., Ltd. 1930. Pp. 538. 16 plates and 85 figs. Price 16s. net.

An extremely well-written book, amply illustrated, and easily read. Its pages contain all the information that a student or practitioner is likely to require, clearly and concisely stated in good print. No space is devoted to purely academic discussion or historical references.

The ætiology, pathology, diagnosis and treatment of all the common and most of the rare diseases and conditions to be met with in children are fully dealt with.

The treatment recommended is in accordance with the most modern teaching. In addition there is a lot of very valuable information on the training and care of the normal child, a knowledge of which is so essential for those who include mothers and children amongst their patients.

The importance of a well-balanced diet is emphasized, and the dangers of fat and carbohydrate in excess clearly indicated. Everyone will not agree that "If there is the slightest tendency to flat foot from laxity of muscles or overweight, small instep supports should be inserted." The mixed diets recommended for infants, from 6 to 9 months, and 9 to 12 months of age, appear unnecessarily complicated, though theoretically sound.

Apart from these two points there is nothing to criticize adversely, and the book, with its great fund of practical information, should meet a very real need.

C. A. W.

Correspondence.

CONTROL OF SALIVA-BORNE DISEASE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—An article in the *Military Surgeon* (U.S.A.) for October, 1930, entitled "Saliva-borne Disease Control; Eradication,"[1] opens a new train of thought, and should make us "furiously to think." The author suggests, and backs his opinion with closely reasoned arguments and a very considerable mass of statistics, that while the air-borne possibilities of droplet infection have been fully recognized, those of what he describes as "indirect transmission," i.e., the parts played by infected saliva and one's feeding equipment, have hitherto not had the attention they deserve, on his side of the Atlantic at any rate. In his view, the transmission rate or method of carriage of infection is always the prime factor in an outbreak of infectious disease, and that "healthy carriers" and susceptible recipients will always be with us; the term healthy carrier including mild missed cases and convalescents.

He points out that efficient control of water and milk kept down to a minimum the potential carriers of enteric and dysentery among recruits during the Great War, while the control of the means of transmission, the vector, did much for malaria, but that the possibilities of saliva-borne infection per mug, plate, etc., were entirely neglected.

Investigations into the methods of utensil washing in the United States Army showed that troops whose mess-kit was washed on a collective basis, i.e., with boiling water, had an incidence of one per cent of influenza as compared to an incidence of five per cent among those who washed their own mess tins in luke-warm water.

A study of the incidence of saliva-borne diseases, measles, mumps, influenza, pneumonia, meningitis, etc., over a period of ten months added additional confirmation, the ratio being as 1 : 6·2 in favour of those whose mess-kits were boiled.

A further study into civilian conditions confirmed these findings.

It is suggested that the author has produced evidence that cannot be disregarded.

At least half the table utensils of the British Army are washed in luke-warm water, while sterilization of cups, glasses, etc., in canteens, though nominally compulsory, is in my opinion of very doubtful efficiency.

While we are fortunately at present free from an epidemic of influenza,[2] tonsillitis is one of the most common causes of admission to hospital, and it is submitted that an investigation into the incidence of droplet or saliva-

[1] Reprinted at page 101 of this Journal.

[2] This letter was written before the present outbreak of influenza.

borne diseases as possibly conveyed by mess-kit would be of the utmost value. If confirmed a revision in our methods of mess-kit washing would naturally follow.

I am, etc.,
N. Low.,
Lieut.-Colonel R.A.M.C.,
Professor of Hygiene.

Hygiene Department, R.A.M. College,
Millbank, S.W. 1.
November 28, 1930.

Notices.

SIXTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY, THE HAGUE.

From June 15 to 20, 1931.

We have just heard that the dates of the Sixth International Congress are definitely fixed. It will be held from June 15 to 20, 1931, at the Hague.

The subjects for discussion are :—

(1) The Recruiting, Training, and Advanced Training of Military Medical Officers and Pharmacists. (Reporting Countries : The Netherlands and Yugoslavia.)

(2) The Psychoneuroses of War : the Immediate and Remote Effects of War on the Nervous System in Combatants and Non-combatants. (Reporting Countries : France and United States of America.)

(3) Methods of Hæmostasis on the Battlefield. Standardization of First-aid Material and the Mode of Application. (Reporting Countries : The Netherlands and Italy.)

(4) The Preparation and Storage of Medicinal Ampoules in Use in the Medical Services, both Naval and Military. (Reporting Countries : The Netherlands and Roumania.)

(5) The After-effects of War Wounds of the Teeth and Inferior Maxilla : Their Treatment. (Reporting Countries : The Netherlands and Poland.)

Officers are invited to submit short papers on any of the subjects for discussion.

The list of fêtes, receptions and excursions will be communicated as soon as possible.

The Commission for Accommodation will arrange to accommodate members of the Congress either at the Hague or at Scheveningen, a seaside resort 3 kilometres from The Hague, situated in a beautiful park.

The Committee of the Congress is organizing at the same time an historical exhibition of the Medical Services of the Navy, Army and Air Forces. This exhibition will consist of engravings, publications, instruments, equipment, uniforms of officers of the Medical Services, etc. Governments are asked to be good enough to collaborate by sending any articles of artistic or historic merit which would be of interest.

The Commission charged with the organization of this exhibition consists of:

(1) Le Médecin Principal de 1ère classe *Denekamp*.

(2) Le Docteur *de Lint*, Professeur agrégé d'histoire de la Médecine à l'Université de Leiden.

(3) Le Médecin Major de 2ème classe *Doornickx*.

(4) Le Docteur *Molema* (Croix-Rouge Néerlandaise).

The subscription has been fixed at 10 Dutch florins for members of the Congress and 5 florins for members of their families.

On British railways and steamers tickets at the rate of single fare and a third for the return journey can be obtained from Messrs. Thos. Cook and Son, Ltd. The Southern Railway have arranged for special fares via Victoria, Gravesend, and Rotterdam by the Batavier Line. Return fare to the Hague: 1st Class, £3 11s. 8d.; 2nd Class, £2 12s. 9d. Further information may be obtained from Major A. D. Stirling, D.S.O., R.A.M.C., War Office, Whitehall, S.W.1, or from the Secretariat, Direction du Service de Santé, Ministère de la Guerre, The Hague, Netherlands, where subscriptions are now being received.

"ABRODIL" FOR INTRAVENOUS PYELOGRAPHY.

During the past two years a number of complex iodine preparations have been evolved for the purpose of intravenous pyelography in order to reduce the necessity of specialized skill required in passing an opaque substance into the renal pelvis by means of a ureteral catheter. Of these preparations, the most recent is "Abrodil," prepared by Messrs. Bayer Products, Ltd.

Chemically, "Abrodil" is sodium mono-iodo-methane sulphonic acid, a white crystalline, odourless powder. The iodine content is 52 per cent. It may be heated for many hours to 100° C. and kept in concentrated solution over prolonged periods without change occurring in the molecule. It is 70 per cent. soluble in water at room temperature. Aqueous solutions may therefore be sterilized by boiling without risk of decomposition and may be kept. A 4 per cent. "Abrodil" solution is isotonic with the blood.

"Abrodil" is usually administered intravenously at body temperature in a 20 per cent. solution, 20 grams of the substance being dissolved in 100 cubic centimetres distilled water, sterilized and subsequently filtered. The total quantity is injected in two to three minutes.

The optimal time for radiographic examination is fifteen to twenty minutes after the injection, unless the excretion is delayed by disturbance of the renal function, when further radiograms at longer periods should be be made. When the renal function is normal, 75 per cent. of the "Abrodil" is excreted at the end of four and a half hours.

"Abrodil" is contra-indicated when there is excretory insufficiency of the kidneys.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1, payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

VOL. LVI. MARCH, 1931. No. 3.

Journal of the Royal Army Medical Corps.

Original Communications.

REMARKS ON TRYPANOSOMIASIS IN RELATION TO MAN AND BEAST IN AFRICA.[1]

By BREVET COLONEL A. E. HAMERTON, C.M.G., D.S.O.
Royal Army Medical Corps (Ret.).

THERE is perhaps no disease that illustrates the association of zoology with pathology—both human and veterinary—more tragically than African trypanosomiasis or tsetse-fly disease, the natural history of which has been under continuous investigation since the classical discoveries of Bruce thirty-five years ago.

Research on the tsetse-fly problem continues and reliable data, slowly acquired by experiment and observation over vast regions of Africa, are accumulating to bridge the remaining gaps in our knowledge of the subject.

Now, in the light of such knowledge accumulated during the last seventeen years I can no longer hold the opinion to which I subscribed in the recommendations of the Royal Society's Commission on Sleeping Sickness in 1913, advising the extermination of wild animals in the "fly" country.

The alleged rôle of the great African Fauna in maintaining the tsetse-fly population and the incidence of human trypanosomiasis or sleeping sickness is still a debatable point and, as it is of special interest to zoologists, I propose to state the case for and against the game very

[1] Published by courtesy of the Zoological Society of London.
The paper, illustrated by lantern slides, was read before the Zoological Society. It will not be published in their *Proceedings*, but has been accepted for publication in the Journal of the Society for the Preservation of the Fauna of the Empire.

briefly but I hope impartially; and incidentally to mention some of the more important observations that have caused me to modify my former views. There appears to be little doubt that the large ungulata on which the existence of the tsetse-fly was supposed to depend have been destroyed almost to the point of extermination in certain parts of the fly country, but the tsetse has remained in these districts as elsewhere; and its eradication, except in small areas that can be kept clear of bush, seems to be impracticable when one considers the vast areas over which some species of this noxious pest are distributed. Incidentally I may mention that on the two Portuguese Islands, St. Thomas and Princes Island, in the Gulf of Guinea, where there are no wild animals, tsetse-flies are numerous and outbreaks of sleeping sickness not uncommon, the causal trypanosome being introduced from time to time probably by native labourers from the West Coast. No man can foretell the result of depriving the tsetse of its accustomed diet of wild animal's blood; but so long as there are men and cattle about the "fly" will not starve, and evidence from various parts of Africa is accumulating in support of the view that game destruction, instead of being a remedy, increases the danger from the fly by causing dispersal of the insects which subsequently concentrate around villages in the bush where they feed mainly on man and inoculate into his blood certain animal-derived parasites which in the game are harmless, but become lethal when introduced into man and his domestic animals.

Instances in which annihilation of the large fauna has been followed by complete and permanent deliverance from the tsetse pest obtain only in certain small isolated spots of territory, south of the Zambesi from which the fly disappeared during the latter half of the last century, notably in parts of the Transvaal and Southern Rhodesia where European occupation and permanent deforestation has followed the destruction of game.

Here again, reference to a map indicating the distribution of tsetse flies will show that it is impossible to apply to half a continent, measures that have been successful in the case of a few comparatively minute and isolated spots in the vastness of Africa. On the other hand instances where the extermination of game has failed to rid the country of the pest are numerous and increasing. The Director of Veterinary Research in Southern Rhodesia in a recent report (1928) [1] states:—

"For several years large sums of money have been spent in the endeavour to eliminate the fly by eradication of the game upon which it is thought to depend, but these operations have not been successful."

An experience that is corroborated by many recent observers. The following may be cited:—

An organized thorough and prolonged killing of game, resulting in the exile of large animals from a wide area in Tanganyika, south of Lake Victoria, was followed by an epidemic of sleeping sickness, from which over 600 natives in the experimental area died as a result of infection with *Trypanosoma brucei* vel *rhodesiense*. Swynnerton published an exhaustive

report on the entomological aspects of this outbreak [2]. He came to the conclusion that in the absence of game the tsetse-fly concentrates on man, and he states there is evidence to show that *T. rhodesiense* in man can originate from *T. brucei* in game in places where the fly has been forced to feed on man; and an infected man entering a village or locality where man is the centre of attraction for the tsetse is the primary factor in spreading the disease, which, once man has acquired, becomes solely man-carried and man-derived.

Lyndhurst-Duke, investigating the epidemic from the epidemiological aspect, came to the same conclusion. He found the natives had killed their cattle for food on account of famine, and in the absence of game, the fly also turned to man for sustenance, with the apparent result that he acquired a *T. brucei* vel *rhodesiense* infection, and the parasite, increasing in virulence in the human body, was rapidly transmitted from man to man by mechanical transmission on the needle-like proboscis of the fly.

Dye, investigating another outbreak of *T. rhodesiense* infection in another locality, states: "The observations recorded point to man being much more dangerous to man than any species of game, and that the infection is carried from man to man by the local village tsetse-fly." Moreover, he found that after the human population had been evacuated from the infected area, the locality in due course became healthy again and safe for man despite the presence of tsetse and the increase of game during his absence [3].

Lloyd and others working in Nigeria confirm the finding that in the absence of game the fly takes to feeding on human blood, and therefore they do not recommend game extermination, but wisely state "any increase of wild ungulata should be watched and should be checked if found to result in increase or spread of the fly."

There is evidence, therefore, that a parasite normally and harmlessly living in the blood of game animals may, under certain conditions, become adapted to living in human blood in which it develops lethal properties.

Attention has been drawn to an experience that appears to indicate the occurrence of the converse process in which a pathogenic trypanosome (*T. gambiense*) distinctly pertaining to man and carried by another species of tsetse (*Glossina palpalis*) has, after prolonged sojourn in the blood of the game during the absence of its human host, apparently reverted to its ancestral type, the distinctly animal trypanosome, *T. brucei*, and so has lost its pathogenicity to man.

The survivors of the great epidemic of sleeping sickness, caused by *T. gambiense* infection that decimated the population of tne Sese Islands in Lake Victoria at the end of last century, were evacuated, and the islands remained absolutely uninhabited by man for twenty years.

The Sititunga antelope (*Tragelaphus spekii*) that is normally a host of trypanosomes of the brucei-gambiense type, increased enormously during the absence of man, and spread all over the islands, replacing man in

providing mammalian blood for the tsetse-fly. Since 1919, several thousands of natives have been allowed to return to the islands where they have continued to live in close contact with the fly and game; yet, according to the most recent reports available, not one case of sleeping sickness has occurred among the island population.

If it can be proved that the trypanosome loses its virulence for man by passing into game, there will be a very good argument in favour of game protection.

It remains to be seen, however, whether this vindication of the game can be generally substantiated, but I think it gains some support from experiments by Taute and Huber, two German investigators operating in East Africa. Taute injected into himself antelope blood containing *T. brucei* vel *rhodesiense* which is believed to be the cause of human trypanosomiasis in Nyasaland, Rhodesia and Tanganyika. He also allowed himself to be bitten by tsetse flies infected with the parasite by feeding on an infected animal. Later he and Huber repeated the experiment on themselves and also inoculated 129 natives with animal blood containing *T. brucei* vel *rhodesiense* [4]. None of the persons under experiment became ill.

These experiments are of great interest, but all they show is that man is resistant to a certain animal parasite, viz., *T. brucei*, of which *T. rhodesiense* and possibly *T. gambiense* are variants or races that become habituated to living in human blood.

Further experiments are necessary to show whether a game trypanosome can become adapted to living in human blood, which *in vitro* appears to be an unfavourable medium, or that the trypanosomes *T. rhodesiense* and *T. gambiense* are human parasites only, like those of malaria. This seems to be an improbable supposition in view of the facility with which these two parasites can be conveyed from a sleeping sickness patient to experimental animals in whose blood they are indistinguishable from those trypanosomes commonly found in naturally infected game.

Now Warrington Yorke, Adams and Murgatroyd have demonstrated that animal-derived trypanosomes, namely, *T. brucei* vel *rhodesiense* and *T. congolense*, are rapidly destroyed in contact with human blood plasma or serum at normal blood-temperature 37° C., whereas *T. gambiense* is unharmed. This seems to afford grounds for assuming that man's immunity to infection with the pathogenic trypanosomes of animals and his relative susceptibility to *T. gambiense* is bound up with this property of his blood-serum.

It must be noted, however, that after a period of several years' passage through animals, a strain of *T. gambiense* was found to lose its resistance to the trypanocidal action of human serum and became readily destroyed by it.

In other words *T. gambiense* after prolonged sojourn in the blood of animals may revert to the *T. brucei* type as regards its serological reactions, a laboratory finding which, if confirmed, will form an interesting comparison with the Sese Island experience.

After an elaborate and most important series of experimental investigations, Warrington Yorke, Adams and Murgatroyd enunciated the hypothesis that:—

T. gambiense, like *T. rhodesiense*, is identical with *T. brucei*, the difference between them being due to numerous passages through the human host.

The source of both trypanosomes pathogenic to man—*T. gambiense* and *T. rhodesiense*—is *T. brucei*, of which the natural reservoir is the game.

The game trypanosome is not pathogenic to man because of the protective trypanocidal action of his blood.

Prolonged man-glossina-man passage has produced the modifications of the parasites which have resulted in the characters of *T. gambiense*, the most striking of which is its fixed resistance to the trypanocidal action of human serum [5].

In human trypanosomiasis, therefore, there is an unknown factor whereby certain animal trypanosomes can be adapted to live in human blood and destroy millions of men.

I hesitate to speculate as to what this factor may be, but I hope experiments may be carried out with a view to ascertaining whether the nourishing of the game-derived-trypanosomes, partly or wholly, on human blood during the prolonged cycle of their development in the body of the insect host, is an influence in adapting *T. brucei*, and possibly other animal trypanosomes, to life in the human body.

The solution of this problem seems to be possible only by carrying out elaborate fly-feeding experiments in which man would have to be the experimental animal.

The discovery of a safe and certain cure for human trypanosomiasis may eventually permit of such experiments being carried out. In the meantime, I submit, we have reason to believe that the large African fauna may act like a buffer state in absorbing the attacks of the tsetse-fly population and that by confining the transmission of their trypanosome parasites to their natural vertebrate hosts, the big game are a means of holding up the fly and preventing its dispersal through the haunts of man and the dissemination of trypanosomes among the human population.

I will conclude these remarks with a quotation from a most exhaustive treatise on the tsetse-fly problem, by two of the world's greatest authorities on the subject, Major Austen and Emile Hegh [6].

"Though there be definite grounds for considering big game as constituting a reserve of food enabling tsetse-flies to subsist in a given region, there is no scientific proof that the presence of these animals is indispensable to the continued existence of the fly."

In view of our limited knowledge the utmost caution seems to be necessary before advising the taking of measures (i.e., game destruction), which would have irreparable results.

REFERENCES.

[1] Report of the Director of Veterinary Research, S. Rhodesia, 1928.

[2] SWYNNERTON. "Entomological Aspects of an Outbreak of Sleeping Sickness in Usukuma, Tanganyika," *Bull. of Entomol. Research*, xiii, 317.

[3] DYE. "Relative Importance of Man and Beast in Human Trypanosomiasis," *Trans. Roy. Soc. Trop. Med. and Hyg.*, November, 1927, xxi, No. 3.

[4] Final Report of the League of Nations International Commission on Human Trypanosomiasis, C.H. 629, Geneva, March, 1928.

[5] WARRINGTON YORKE, ADAMS and MURGATROYD. "Studies in Chemotherapy—the Action *in vitro* of Normal Human Serum on the Pathogenic Trypanosomes and its Significance," *Annals of Trop. Med. and Parasitol.*, April, 1930, xxiv.

[6] AUSTEN and HEGH. "Tsetse-Flies—their Characteristics, Distribution and Bionomics." Imperial Bureau of Entomology.

COMMENTS ON THE ANNUAL REPORTS OF ASSISTANT AND DEPUTY-ASSISTANT DIRECTORS OF PATHOLOGY FOR THE YEAR 1929.

BY THE MEDICAL DIRECTORATE, INDIA.

THE results obtained in the more important examinations carried out by military laboratories in India during 1929 have been compiled, and have been circulated for information. It is considered that a perusal of the results obtained by different laboratories indicating the main incidence of laboratory investigated diseases, the co-operation in different districts between hospitals and laboratories, the effect of the introduction of trained laboratory subordinates, and the application of improved methods of bacteriological technique should be of value to all workers in laboratories.

There has again been an increase in the total amount of work done. New laboratories have been completed at Lucknow, Peshawar, and Murree, and were almost completed at Ranikhet, Kohat, Lahore and Razmak, while structural improvements have been carried out in the laboratories at Maymyo and Jhansi.

The addition of sub-assistant surgeons to the staff of laboratories has proved a success, and in most cases, the technical staff of laboratories is considered sufficient, though it is realized that in some stations during certain periods of the hot weather, the staff would be hard put to cope with the work received without the help of personnel under training. It is also realized that the provision of a clerk and a second sweeper is a necessity for more successful working in certain laboratories. These will be provided as soon as funds can be made available. Shortage of funds has also been responsible for the non-provision of typewriters; this question is again being put forward as a new demand.

During the year, 6 officers, 11 assistant surgeons, and 20 sub-assistant surgeons, qualified after a course in laboratory technique. Most of these have been posted to laboratories, and much of the improvement in the work done, especially by brigade laboratories, must be attributed to the painstaking work carried out by the officers responsible for their training.

Several junior officers, and a large number of assistant and sub-assistant surgeons were given instruction in clinical side-room work, and many officers commanding hospitals comment on the improved work done in these rooms. The perusal of reports, however, leads to the inevitable conclusion that clinical side-room work can still be very much improved. One Deputy Assistant Director of Pathology reports that thirteen per cent of the malaria slides submitted to him for confirmation were incorrectly

diagnosed. Such an improvement can be accomplished only with the aid of the officers commanding hospitals and the officers in charge of medical wards. It must be realized that, according to regulations, the officer in charge of wards is responsible for the correctness of results obtained in clinical side-rooms, and that although trained assistant and sub-assistant surgeons are a great help, they in no way relieve the medical officer in charge of the case of his responsibilities in this connection. It is realized that this work would be greatly facilitated were the clinical side-rooms actual annexes of medical wards, but such a provision is impracticable for financial reasons.

With few exceptions, the equipment of laboratories is now adequate. Certain officers in charge of laboratories are still inclined to be sparing in the use of petri dishes. Although the original cash allotments to laboratories are in some cases less than the amounts asked for by officers in charge, a second circular is always sent to all laboratories in October asking if they require a supplementary allotment, and extra money is granted for all reasonable expenditure. The provision of extra incubator space where required is being arranged.

It has been reported by the Deputy Assistant Director of Pathology, Mhow district, that distilled water made in old copper stills is frequently acid in reaction. This matter should be carefully gone into in all laboratories using these stills, and the apparatus reported unserviceable if necessary.

Some Deputy Assistant Directors of Pathology note that the submission of a duplicate copy of Army Form M. 1265-D is unnecessary. This is concurred in. As laboratories now keep complete records of all examinations carried out, the duplicate copy of this form is no longer necessary and para. 182, sub-para. 2 of Regulations for the Medical Services of the Army in India is being amended to read :—

> "When a medical officer sends specimens for examination to the District or Brigade Laboratory, he will make out I.A.F.M.-1265-D and forward it along with the specimen to the pathologist, who will complete the form and return it to the hospital where it will be placed with the patients' clinical records."

As regards the system of recording results, it is considered advisable to leave this to the individual officer in charge, but it is suggested that the introduction of a simple card index for the recording of examinations made in suspected enteric group cases, and any others requiring protracted bacteriological examinations, would be of value.

A record of work done should be maintained in clinical side-rooms, the register being divided into the various sections required.

A note has been made in several reports of the increased number of samples of water submitted for examination. In this connection it is considered that the bacteriological examination of samples of unchlorinated water for *B. coli* is *as a rule* quite worthless in this country. There are

of course exceptions, as in the case of municipal supplies which are examined throughout the year as a routine, but the usual samples sent to military laboratories are not of this nature, but from shallow wells, and sources to be used temporarily for training camps, etc. All such samples contain *B. coli* in very small quantities of water and bacteriological examinations are a waste of time and money.

A detailed pamphlet on the occurrence and diagnosis of enteric and dysentery cases, and on the measures at present in force for the detection of carriers of these infections, is being printed for issue to all officers and members of the I.M.D., and little remains to be commented on here beyond certain technical details regarding the isolation of enteric and dysentery organisms.

Enteric Cases.—The large number of contaminated blood-cultures is still disappointingly high, particularly in the case of those received from Indian Military hospitals. Many of these are undoubtedly due to lack of care in the simple operation of sterilizing the syringe or of removing it from the sterilizer, but some are also due to the use of old culture media or to fresh media which have been sent out inefficiently sterilized. Both these causes of contamination should be easily eliminated. One D.A.D.P. has pointed out that success may be obtained even from a blood-culture heavily contaminated by cocci by emulsifying in broth a loopful of cocci colonies containing suspicious looking blue colonies and plating again on litmus lactose agar. In this way discrete colonies of *B. typhosus* were obtained three times, and of *B. paratyphosus* A once.

Certain laboratories carried out a series of tests using both sodium taurocholate medium and bile medium for blood-culture work in lieu of only one medium. On the whole it appeared that taurocholate medium gave rather better results than bile medium. Some laboratories found that inoculating blood into two separate bottles of bile or sodium taurocholate media was an improvement in that pure growth might be obtained from one while the other was contaminated. Others did not find the use of two bottles of any real advantage. It was mentioned by one D.A.D.P. that fractional sterilization of bile medium in the steamer is more satisfactory than sterilization in the autoclave.

The use of Wilson and Blair's medium has been largely given up, the results in most cases not justifying the expense of using an extra medium. In one laboratory it is still used "as a useful check" on litmus lactose agar, and in this case, the officer in charge reports that the colonies found rarely give the appearance described by the authors. *B. typhosus* colonies after twenty-four hours' growth are described as being colourless, or with a black centre and a clear periphery. The metallic lustre described by Wilson and Blair is stated to be rarely seen. *B. paratyphosus* A colonies give less regular appearances. In the brilliant green variation of the medium, a greenish colour developing round the colonies is considered as being suggestive of their belonging to the enteric group.

The use of MacConkey's medium in certain laboratories has not been conspicuously justified by the results obtained.

As regards taking of blood-cultures, it need only be mentioned here that all reports are unanimous on the following points:—

(1) They are most successful when taken early in the course of the disease.

(2) They are frequently successful when taken later in severe cases and especially during relapses—so much so that repeated blood culture is well worth doing in the primary pyrexia, and always on the occurrence of a relapse.

(3) They are bringing to light a gradually increasing number of abortive typhoid cases among the short fevers group, and, if the regulations on the subject were strictly complied with, would probably show that a much larger number of such cases occur than has been realized. Similarly if blood-cultures were taken from all pneumonia and bronchitis cases among Indian troops, the percentage due to typhoid infection would be found higher than our statistics show at present.

Isolation of enteric organisms from the stools and urine has not been very successful, and perusal of the reports indicates that the lack of success is partly due to the existence of phases in the disease during which alone excretion of the organisms occurs in large numbers. It is noted that when they are isolated from stools and urine, they are generally present in such large numbers that their isolation presents no difficulty, and that they are frequently isolated from both fæces and urine on the same day.

The D.A.D.P. Meerut District has reported three interesting cases of typhoid fever in which, on at least one occasion, stools were passed containing an appreciable amount of mucus. In one of these the stool was forwarded in glycerine and saline solution for examination for cysts and dysentery organisms. In each case the mucus when plated out produced colonies of *B. typhosus*; in one case practically in pure culture. The passage of such mucus, especially after a period of constipation, is therefore worth looking for.

The investigation of "O" agglutinins in the diagnosis of enteric cases is not sufficiently advanced to warrant the issue of a preliminary report. It is hoped that all officers in charge of laboratories will carry out as many complete tests as possible, and have their reports *on the lines asked for* ready by the end of the year.

The position of *B. fæcalis alkaligenes* as a pathogen requires further investigation especially as regards the serological identity of strains isolated. It is probable that the bacilli reported as such from some laboratories are not strains of this bacillus at all, or that under this term are included many bacilli differing in certain antigenic constituents.

Dysentery.—The dysentery results again show an improvement on those of last year, an improvement which is probably due to the better liaison

between laboratories and hospitals. Officers should be encouraged to examine mucus from their cases in clinical side-rooms, and send duplicate specimens to the laboratory, in order that correct early treatment may be administered to the patient, and to familiarize themselves with the appearance of bacillary exudates, etc.

One point to be remembered in laboratories is that it is possible to over-wash mucus in saline before plating, and that in the case of mucus sent from out-stations in glycerine and saline solution, further washing in the laboratory is usually unnecessary.

As regards the agglutination of Flexner strains by stock high titre sera the D.A.D.P. Madras District considers that a more definite end-point is obtained by using a saline emulsion of organisms from agar slopes. Tests done with such emulsions are, however, more liable to show inhibition zones.

Certain points regarding the organism reported as *B. schmitz* (*B. ambiguus* Andrewes) by all laboratories definitely require investigation.

The question of specific immune substances in the serum of patients suffering from dysentery, from whom *B. schmitz* and no other dysentery bacillus has been isolated is important, as it is *not* accepted universally that *B. schmitz* is a definite causative agent of bacillary dysentery, owing to the fact that agglutinins to the homologous organism have seldom been demonstrated in patients' sera. In the outbreak of dysentery in a Roumanian prisoners' camp in 1916, investigated by Schmitz, this worker stated that the patient's serum agglutinated the bacillus from 1/500—1/1000. Shiga's bacillus was agglutinated to much the same titre, and Flexner's bacillus to between 1/200—1/500.

Andrewes (1918) who named *B. schmitz*, *B. ambiguus*, considered that there was no positive evidence in favour of its being a pathogenic agent.

Manson-Bahr (1919-20) regarded it as the product of a stale dysentery stool, or derived from the necrotic mucosa. No facts appear to have been brought forward to support this statement.

Dudgeon in Salonika (1919) reported that he had found agglutinins in the blood of *one* patient, and therefore holds that it is definitely a pathogenic agent.

Manifold (1926) reported agglutinins present mainly on the eighth, twelfth, sixteenth day after onset to the *stock B. schmitz* culture in four out of eleven cases, but *not* to the homologous bacillus, and considered the lack of agglutination to the homologous organism to be due to the inagglutinability of the recently isolated cultures of *B. schmitz*.

Boyd also reports in his annual report (1929) that the strains isolated by him were agglutinated by serum supplied by the Enteric Laboratory, Kasauli, to only twenty per cent of titre, and that a serum made in his own laboratory from recently isolated strains, which with difficulty agglutinated its own bacillus and other recently isolated strains in a dilution of 1 in 250, agglutinated the laboratory stock emulsion in a dilution of 1 in 1,000.

Absorption tests proved that the recently isolated strains, and stock culture were the same bacillus.

A large series of agglutination tests with serum from cases infected with *B. schmitz* on :—

(1) Emulsions of recently isolated strains of *B. schmitz*,
(2) Emulsions of stock culture of *B. schmitz*,
(3) Emulsions of *B. flexner*, and *B. shiga*,

and also control tests with serum of patients sent for Widal tests, not suffering from dysentery, would be a very suitable subject for an article by a D.A.D.P. The evidence on this subject is both scanty and contradictory at present.

Two further points in relation to *B. schmitz* requiring investigation are :—

(1) Whether all the organisms reported from laboratories as *B. schmitz* in reality fall into one group. As Major J. S. K. Boyd, R.A.M.C., D.A.D.P., Bangalore, has been working at this subject, officers in charge of laboratories are requested to send him subcultures of all *B. schmitz* isolated in their laboratories.
(2) The relationship of *B. schmitz* to *B. shiga.*

Topley states "an anti-Shiga serum has some agglutinating action on Schmitz bacillus, and on some strains of the Flexner group. A serum prepared against Schmitz bacillus will agglutinate a Shiga bacillus to 1/4 to 1/2 titre, but antigenically they are shown to be quite distinct," by absorption tests.

Dudgeon was unable to agglutinate any of his strains isolated in Salonika with anti-Shiga serum prepared at the Lister Institute, R.A.M. College, or the laboratories in Macedonia. He quotes "Gehrman" 1918, as stating that "it is necessary to heat the Schmitz strain to 100° C. for one hour, before it becomes agglutinable," but says it is difficult to understand on what evidence this statement is based.

It will be seen that the evidence on this point is quite contradictory and that it also requires investigation. Dudgeon called *B. schmitz*, *B. para shiga* +, and also isolated a strain from dysentery cases, which he called *B. para shiga* – (1919). This was similar to the true Shiga bacillus in that it did not form indol, but the final alkalinity in milk did not develop with every strain, as he apparently considers is the case with *B. shiga.* It apparently was not a Shiga bacillus, as anti-sera prepared from it did not agglutinate *B. shiga*, and agglutinins were absorbed from it only by *B. para shiga*, and by no other organism.

B. alkalescens is seldom reported by laboratories. It is suggested that dulcite should be used in addition to glucose and mannite, particularly for inagglutinable strains of supposed *B. flexner*.

Andrewes discovered this bacillus in 1918 and considered it to be a

probable cause of bacillary dysentery. Cultural reactions are similar to *B. flexner*, except that it produces alkali with much vigour in litmus milk which turns dark blue in seven to ten days, the blue colour eventually becoming slatey-acid, but no gas from glucose, maltose, mannite, and none from lactose or saccharose. Indol reaction is positive.

Dudgeon considers the dulcite reaction a very uncertain criterion, as many strains of flexner *acidify* dulcite at some period, and favours the view that occasional fermentations are due to variation of bacilli. He considers *B. alkalescens* to be a variant, and not a distinct strain. It should be pointed out that *B. alkalescens* is quite distinct serologically from *B. flexner*.

Topley considers the relationship of *B. alkalescens* to dysentery in man extremely doubtful, and "though it shows some relationship to the Flexner bacilli, it is clearly of a separate type."

He states that dulcite is fermented by *B. alkalescens* alone, and that *B. alkalescens* is definitely non-toxic to animals.

It will be seen therefore that there is much difference of opinion, and it is again suggested that the incidence of *B. alkalescens* in dysentery cases, the question of its agglutinability by the serum of patients and other sera of dysentery group bacilli, and of the serological identity of all strains isolated, would be a suitable subject for a D.A.D.P. to take up.

Bacillus dispar.—This bacillus is also seldom reported, probably because in many laboratories the lactose tube from a bacillus considered to be *B. flexner* is not kept as a routine in the incubator for a sufficient number of days (should be up to fourteen days in all cases).

The bacillus agglutinates to some extent with Flexner serum, and therefore can easily be distinguished from *B. sonne*. It has been reported from cases by District Laboratory, Razmak, during the past year, and five strains were reported by District Laboratory, Poona, in 1928.

The serological relationship of this group of bacilli to *B. sonne* and *B. flexner* requires working out, and if looked for, strains will probably be easily found.

It will be seen from the above that further work is required on *B. schmitz*, *B. alkalescens* and *B. dispar*, and it is hoped that certain of the D.A.D.sP. will take up these questions, as the amount of individual research work by D.A.D.sP. appears to have definitely fallen off during the past two years.

Several laboratories report *B. morgan* No. 1 among the organisms considered as causative of dysentery.

In the Medical Research Council "System of Bacteriology," 1929, Dudgeon states, "There is no conclusive evidence that Morgan's bacillus is the cause of intestinal disturbance or any other disease in man. The widespread belief that diarrhœa and even dysentery may be caused by its multiplication in the intestine, rests on the impression of the bacteriologists, who are naturally prone to attribute ætiological significance to any bacillus that appears in large numbers in a disordered colon. These impressions

may or may not be true, but the failure of the agglutination test is against their truth, and there are no records of accidental or intestinal infections with pure cultures to prove the point directly."

Topley also points out the diversity of the findings on this subject, and it is considered from personal experience that if sufficient non-lactose fermenting colonies, say five to six, are picked off each plating of a dysentery stool particularly in *B. flexner* infections, *B. morgan* No. 1 will be found in the early stages of dysentery in most platings in small numbers, but in gradually increasing numbers as the disease progresses. A carefully kept series of figures on this point would be useful. Morgan and Ledingham detected a supernormal agglutination (normal sera reacting at one in ten) with half their cases, but other workers have failed to confirm these observations. Further carefully controlled observations on this point would be all to the good, as the supply of material in India is large.

As regards Sonne dysentery, an investigation in Aberdeen by J. Smith and A. N. Fraser has recently been reported in the *Journal of Hygiene* (June, 1930). They consider that, in the majority of cases, an attack of Sonne dysentery gives rise to the presence of specific agglutinins in the serum of the individuals concerned. They also believe that an agglutination titre (in Aberdeen) of 1/50 or greater in the serum of an individual, indicates a past infection with the Sonne bacillus, provided a suitable suspension of *B. dysenteriæ* Sonne is used in the test. It is suggested that a series of such tests using serum from *B. dysenteriæ* Sonne infections, and serum sent to the laboratory for Widal tests, would make a useful subject for an article by a D.A.D.P.

In some districts orders are in force to the effect that all men suffering from diarrhœa are to report sick at once. It is believed that saline treatment in such cases frequently has the effect of "arresting" an attack of frank dysentery, the organisms and their toxins being washed away before the former have an opportunity of firmly establishing themselves.

Undulant Fever.—During the year certain cases of a typical pyrexia have been encountered whose serum agglutinated *B. melitensis* and *B. abortus* in moderately high dilution (> 1/100). The occurrence of such agglutinins in India may be comparatively common, and the question has arisen as to what should be considered a diagnostic titre. In this connection, the observation of Nègre and Raynaud that non-specific agglutinins are inactivated by previously heating the serum under observation to 56° C. for half an hour, should be borne in mind, although later workers have found that in some cases certain specific agglutinins may also be inactivated by exposure to this temperature before carrying out the test at the recommended temperature of 37° C. to 40° C.

Provided sufficient controls are put up, preliminary exposure of the racks to 56° C. for half an hour may prove of value in investigating the possibility of a true brucella infection.

P. U. O.—During the year under review, that last resort in "diagnosis,"

P. U. O., was still under suspicion. Most of the cases so labelled were suggestive of enteric group infections. It is to be noted that the absence of positive laboratory tests in adequately examined cases of typical clinical enteric fever should not be held to negative a diagnosis of enteric group.

In Mhow district, three cases resembling typhus fever were returned as P. U. O. owing to the absence of epidemic cases of typhus in the district. They might well have been returned as cases of the disease, which they so closely resembled.

Diphtheria.—There has been a distinct increase in diphtheria in certain stations and it must be admitted that in some cases laboratory examinations have not been particularly successful either in diagnosing the cases or in tracing the source of infection. It is considered that better results would be obtained if more care were exercised in the actual swabbing of the throats with particular reference to the time of swabbing as related to the previous use of disinfectants. It is becoming increasingly evident that diphtheritic infection of the fauces in India is frequently present in the absence of the typical text-book signs, and several cases have occurred where the specific infection has been realized only after the advent of a toxic paralysis. Measures should be taken to ensure the adequate swabbing of all sore throats which do not react at once to routine treatment whether the appearances are suggestive of diphtheria or not. The taking of nasal swabs has been largely disregarded.

In this connection some interesting results were obtained at a diphtheria carrier clinic held in Guy's Hospital and reported in the Guy's Hospital Reports, July, 1929. The patients investigated were school children who, during periodical swabbing in connection with outbreaks had been found to be carriers, and who, while kept at home, by re-swabbing at weekly intervals, were still found to be carriers at the end of a month. Between July, 1926, and April, 1928, 140 cases were examined. From 70 of these diphtheroids only were isolated. From the remaining 70 the Klebs-Loeffler bacillus was isolated as follows :—

N = Nose only.
T = Tonsils only.
T & N = Tonsils and nose.
E = Ear.

KLB virulence not tested—	N	3		
	T & N	1	5	
	T	1		
Doubtful virulence	N	3		
	T & N	1	5	
	T	1		24
Non-virulent—	N	7		
	T & N	3	14	
	T	4		
Virulent	N	16		
	N & E	1		
	T & N	17		46
	T, N & E	1		
	T	11		
				70

Of the forty-six cases from whom virulent K.L.B. were obtained, twenty-five came to be regarded as "carriers" and among these the situation of K.L.B. was as follows :—

N	11
N & E	1
N & T	8
T	5

The number of nasal carriers therefore formed a large percentage of the total number, and, as generally noted before, it was confirmed that the majority of these had some abnormal nasal condition where the K.L.B. were leading a saprophytic existence on pus or mucopus. Cases carrying K.L.B. in the nose, in addition to other places, were treated as pure nasal carriers, the infection in other places disappearing when the nasal infection was cured.

The fallacy of basing a diagnosis on negative superficial throat swabs was proved by the experience that such swabs could be taken from known carriers with all due care twice weekly for three weeks, and fail to give a growth of K.L.B. In such cases it was found that K.L.B. in pure culture could frequently be obtained from the deep crypts of the tonsils sectioned after tonsillectomy.

The general conclusions arrived at as regards the control of the disease, at any rate in school children, was that the most effective line of attack was by "Schick testing and immunization."

In the search for diphtheria carriers, very large numbers of throats have been examined by throat swab, and variable numbers of carriers in different stations have been detected. It is considered that in some stations more carriers might have been discovered had the examinations been confined to more direct contacts, and had more numerous examinations of these contacts been made. As regards carriers, the manner in which the throat swab is taken is of great importance, and, whenever possible, the specimen should be taken in the laboratory. The use of tellurite serum agar has been recommended by the D.A.D.P., Meerut District, for the isolation of the organism, especially in the case of suspected carriers.

There are various modifications of this medium, one of which, containing copper sulphate, was favourably reported on in the *Journal of Pathology and Bacteriology*, Vol. xxxii, No. 2, of April, 1929, but the modification found useful in Meerut was the following :—

Peptone water agar	pH 7·2	100 c.c.
Sheep's serum	..	5 ,,
Potassium tellurite	1 per cent.	2 ,,

The serum is added to the melted agar at 50° C.

As regards virulence tests, the difficulty of obtaining the diphtheria bacillus in pure culture is well known, and the method of inoculating into a protected and an unprotected guinea-pig a 1 c.c. emulsion of a sweep from a Loeffler slope is quite an efficient method of determining virulence,

and is employed as a routine in many laboratories in England with excellent results.

Cerebrospinal Fever.—Cerebrospinal fever occurs sporadically in Nasirabad. The meningococcus was isolated from the cerebrospinal fluid in five cases out of eight. Four of these strains were investigated serologically and failed to agglutinate with the stock sera available. Agglutinating sera were prepared from three of these strains, and each serum agglutinated the homologous and heterologous strains to full titre.

From 677 nasal swabs, forty-three organisms resembling meningococci were isolated. Fourteen of these were found to be inagglutinable by stock high titre sera, but the eight strains surviving when local high titre sera were prepared were all agglutinated to full titre by these sera.

It would appear that the organisms isolated in Nasirabad differ from the American types and form a distinct monovalent type, but further investigation is necessary to substantiate this.

Ankylostomiasis.—High figures of ankylostome infection have been obtained in Razmak by the examination of specimens of fæces prepared in saturated saline solution, as advocated by Yorke and Adams.

The differentiation between ankylostome ova and necator ova varies greatly in the different Commands. The Command Laboratory, Poona finds three necator ova to one ankylostome ovum. The D.A.D.P., Waziristan District, considers that the differentiation by measurement does not give sufficiently clear-cut results to warrant any classification. While this is to a certain extent true, it is considered that the majority of the ova can be differentiated in this manner to give sufficiently approximate results.

Blood Typing.—The number of blood-grouping tests varies considerably in the different laboratories. While the maintenance of up-to-date lists of blood donors in stations is not one of the duties of the laboratory, it is one of the duties of the officer-in-charge to be able to carry out such tests whenever called upon to do so, and fresh type II and III sera should always be available.

———

CINCHONA ALKALOIDS AND BARK IN MALARIA.[1]

By W. T. DAWSON, M.A.Oxon.

Professor of Pharmacology, University of Texas Medical Branch, Galveston, Texas.

The cinchona alkaloids form one of the most important groups of drugs. Quinin, the chief member of the group, is still the main reliance of the physician in the treatment of malaria, a disease which almost constantly infects 800,000,000 people (Müller) [1], and causes annually about 2,000,000 deaths (Ross) [1]. No cinchona alkaloid, available at present at a cheaper price than quinin, is more effective than the latter in the cure of malaria, but quinidin appears to be its equal, and claims have been made that ethylcuprein and hydroquinin are superior. It has also been claimed that cinchonin and cinchonidin are of antimalarial value equal to quinin, and much evidence has been adduced tending to prove this for benign tertian fever. In a number of cases of quinin idiosyncrasy the substitution of quinidin or cinchonin has been found to cure the malaria without recurrence of the troublesome side-effects due to the quinin, e.g., urticaria. The study, therefore, of the cinchona alkaloids as a group is of greater interest and value than is suggested by the bald statement of some authors that quinin is the only drug of value in malaria.

The present chief source of cinchona alkaloids is the island of Java. In its elevated regions the Dutch have scientifically cultivated the beautiful blossoming ledgerian variety of an originally Bolivian tree, *Cinchona calisaya* ("yellow bark"), grafting shoots of this tree upon a hardier stock, *Cinchona succirubra* ("red bark") which supplies the roots [2]. In the name "ledgeriana" is commemorated that of Mr. Charles Ledger, who, in 1865, shipped from Peru to London a packet of the seeds. The latter were obtained in the Bolivian forests by Mr. Ledger's old Indian servant, Manuel Incra Mamani, whose name even more deserves record in the annals of medicine. He spent four years in the search, for seeds did not ripen every year, and on his return to Bolivia was so ill-treated, for having harmed the industry of the bark-collectors, that he died [3]. All that Mr. Ledger obtained from the sale of the seeds in London, one hundred pounds, he gave to Manuel's widow [4].

The Dutch specialized upon the cultivation particularly of *C. calisaya ledgeriana* because of the high quinin content of the bark, which they have improved by cultivation and selection. Bark has been obtained, yielding, dried, as high as 13·5 per cent. of quinin alkaloid [2]. This is

[1] Published by permission of the author and of the editor of *International Clinics.* "This article is copyrighted by the J. B. Lippincott Co., and appeared in the *International Clinics*, Series 40, vol. ii, 121-149, 1930."

now the principal bark of commerce, and the following figures (Table I) for the average contents of bark worked at Howard's (London) quinin factory, 1919-1923, probably give a very good picture of the nature of the present supply of cinchona alkaloids. The bark worked was mainly Java *ledgeriana* [5], the imported bark of world trade. The bracketed figures show Java *ledgeriana* [6].

TABLE I.—AVERAGE ALKALOIDAL CONTENT OF DRY COMMERCIAL, MAINLY BARK OF CINCHONA CALISAYĀ LEDGERIANA.

Quinin alkaloid ..	..	4·143 per cent (4·4-5·1)
Cinchonidin alkaloid	..	0·542 per cent (0·4-0·6)
Cinchonin alkaloid	..	0·381 per cent (0·3-0·4)
Quinidin alkaloid	..	0·170 per cent (0·16-0·2)
Amorphous alkaloid	..	0·888 per cent (0·8 -1·6)

It will be seen that in ledger bark, quinidin is the least abundant of the four common alkaloids. It is obtained entirely from the root bark, i.e., probably the *C. succirubra* roots, the stem and branch bark containing usually no quinidin [6]. More abundant sources of quinidin might be other species of cinchona tree, such as *C. officinalis*, but quinidin is not particularly abundant in the bark of any cinchona species. Quinidin sulphate is official in the United States "Pharmacopoeia," and is principally used in the treatment of auricular fibrillation, where it is five to ten times as effective as quinin, cinchonidin and cinchonin occupying intermediate positions [7].

Cinchonin sulphate is official in the United States "National Formulary." During a war shortage of quinin it came into considerable use in Italy (1918) and, despite the ominous declarations of certain authors of textbooks, was found no more toxic than quinin, useful in doses of 1-3 grams (15-45 grains) daily, and a great boon in certain cases of quinin idiosyncrasy.

Cinchonidin sulphate is official in the United States "Pharmacopoeia." Cinchonidin is used to some extent in denaturing alcohol for cosmetic purposes [8]. It has also been used in the treatment of malaria. The writer is informed by manufacturers of quinin that the chief demand for cinchonin and cinchonidin is from some of the makers of popular chill tonics sold in the Southern States. There is abundant evidence that either of these alkaloids will cure malaria, although it has not been proved that they are as active as quinin or quinidin in malignant tertian fever.

Present prices of the sulphates (the cheapest form) of the alkaloids reflect the law of supply and demand, quinidin being most expensive, then quinin and cinchonidin about the same price, and cinchonin cheapest of all.

The amorphous alkaloids ("quinoidin") of cinchona bark have been tried on numerous occasions in the treatment of malaria and been found rather toxic, with a pronounced tendency to produce nausea, vomiting, diarrhea. Much more important are the cinchona febrifuges, of various origins,

containing mixtures of unseparated crystallizable and amorphous alkaloids as shown in Table II [5, 6]; Waters [5] reported more disagreeable side-effects from febrifuge than from quinin.

TABLE II.—APPROXIMATE COMPOSITION OF CINCHONA FEBRIFUGES.

Alkaloids	Madras, 1923	Bengal, 1922	Javanese 1924	Javanese 1922	English 1930
Quinin..	8·0	10·5	5·8	11·9	6·2
Cinchonidin	21·0	7·0	12·2	9·2	7·2
Cinchonin	21·0	23·0	20·0	15·3	28·8
Quinidin	4·5	16·0	8·7	4·8	8·7
Amorphous	30·0	33·0	41·3	45·4	45·0
Ash, moisture, &c. ..	—	10·5	3·7	—	4·2

Cinchona febrifuges possess the advantage of cheapness owing to the simplicity of their manufacture from various barks, or from the residues after quinin removal. They are effective. The composition is, however, subject to considerable variation, as may be seen from the table. Mr. Bernard F. Howard [5] has emphasized the grave danger of adulteration by unscrupulous retailers, since only an expert cinchona chemist can make an accurate analysis of cinchona febrifuge, and even then ten days' work is involved. Similar preparations have been sold under the name of "quinetum," a name which has also been applied to mixtures of the crystallizable alkaloids, the amorphous being excluded.

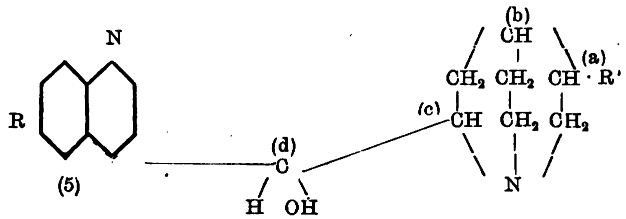
The four common crystallizable cinchona alkaloids, as prepared to conform to medicinal (U. S. P. or B. P.) standards are not pure, as shown in the following table [6]:—

TABLE III.—PROBABLE IMPURITIES OF MEDICINAL CINCHONA ALKALOIDS (U.S.P. OR N.F., B.P.).

Alkaloid (or sulphate)	Approximate percentages of impurities
Quinin	Cinchonidin, 2 per cent; hydroquinin, 1·5 per cent.
Quinidin	Hydroquinidin, 6 to 30 per cent.
Cinchonin	Hydrocinchonin, 10 per cent.
Cinchonidin.. ..	Quinin, 10 per cent; hydrocinchonidin, 8 per cent.

The hydrochlorides and other so-called minor salts may be purer. The quinin sulphate of the German "Pharmacopœia" ("Deutsches Arzneibuch," 1926) is stated to be absolutely pure [9]. Commercial quinin formerly often contained the related alkaloid cuprein, from the use of a *Remijia pedunculata* bark in making quinin, but this bark is not now in any extensive commercial use [9]. It will be seen from the table above that each of the common alkaloids has associated with it a "hydroalkaloid." The latter differs in each case by the possession of an additional two atoms of hydrogen, converting a $CH = CH_2$ group into a $—CH_2 —CH_3$ group. These hydroalkaloids are prepared by the action of hydrogen in the presence of a catalyst, such as palladium black. The chemical relationships of all the alkaloids which have so far been mentioned,

together with those of a number of others which have been prepared and tried in the search for antiperiodics superior to quinin may be seen from the following formulas and tables.



GENERAL FORMULA, CINCHONA ALKALOIDS. The asymmetric carbon atoms are lettered.

TABLE IV.—PRINCIPAL CINCHONA ALKALOIDS TESTED IN MALARIA.

The first alkaloid of each pair is levorotatory, the second its dextrorotatory isomer. Where only one is given, it is levorotatory.

Cuprein Series, R′ = CH : CH_2.

R = (H), cinchonidin, cinchonin.
= OH, cuprein.
= OCH_3, quinin, quinidin.
= OC_2H_5, ethyl cuprein.

Hydrocuprein Series, R′ = CH_2 . CH_3.

R = (H), hydrocinchonidin, hydrocinchonin.
= OH, hydrocuprein, hydrocupreidin, neither tested as yet.
= OCH_3, hydroquinin (methylhydrocuprein), hydroquinidin (methylhydrocupreidin).

Aminohydroquinin, NH_2 Group at (5).

= OC_2H_5, optochin (ethylhydrocuprein).
= OC_3H_7, cincain (isopropylhydrocuprein).
= OC_5H_{11}, eucupin (isoamylhydrocuprein).

Quitenin Series, R = CH_3O.

R′ = COOH, quitenin.
= $COOC_2H_5$, ethylquitenin.

The optical isomerism in each pair of alkaloids is believed to be due to different spatial arrangements of the atoms around the carbon atom (c), or around carbon atoms (c) and (d) [9] [10].

VALUE IN MALARIA OF VARIOUS SYNTHETIC RELATIVES OF QUININ.

As might be surmised from the table of the cuprein series of alkaloids (*vide supra*), quinin is methylcuprein. Grimaux [11] showed that it could be prepared by the methylation of cuprein. He further prepared higher homologues, particularly ethyl- and propylcuprein. After these had been tested for toxicity by Laborde [12], they were given a trial in malaria by Bourru [13]. Bourru found that cuprein hydrochlorid interrupted the paroxysms of fever only in doses of 1 gram or more and that even these doses were not at all reliable; the toxic effects were nil in doses 1-1·5 grams. Ethylcuprein (quinéthyline) sulphate was administered in five cases of quotidian, one of tertian, one of quartan fever. A dose of 0·5 gram

(grain viij) usually did not interrupt the succession of paroxysms but 0·75 gram (grain xij) was uniformly successful. The toxic effects were stated as less than with quinin. Propylcuprein (quinopropylin) sulphate was tested in seven cases and found still more effective than ethylcuprein but caused severe cinchonism in all cases even in doses of 0·6 gram (grain x), which was not therefore exceeded. Bourru considered that he had proved that ethylcuprein was superior to quinin. But Laveran [13] promptly objected to the method used by Bourru in at least two cases (and Bourru treated only seven with ethylcuprein) in giving the ethylcuprein at a day's interval after two days' unsuccessful use of quinin, because, as Laveran pointed out, the quinin might well have modified the condition even if it had not yet terminated the paroxysms. Giemsa and Werner [14] found ethylcuprein (chinäthylin) effective, in doses of 0·3-0·4 gram daily, in causing prompt disappearance of parasites and fever and also considered it superior to quinin. The question as to the possible superiority of ethylcuprein over methylcuprein (quinin) is therefore again *sub judice*. Ethylcuprein would probably be extremely expensive to produce even on a large scale. It is made by ethylation of cuprein. Cuprein must be got from *Remijia* bark, in which there is not now much trade. Cuprein cannot be got from quinin by demethylating the latter, since this reaction yields an isomer of cuprein, apoquinin, whose constitution appears to be unknown [10].

Baermann [15] tested the antiperiodic activity of a number of alkylhydrocupreins. In preparing these, quinin is hydrogenated to hydroquinin, the latter demethylated to hydrocuprein, and this compound alkylated, resulting in the production of ethyl-, propyl-, isopropyl-, etc., hydrocupreins. He reported the following results, with oral administration :—

TABLE V.—RESULTS OF TREATMENT WITH ALKYL HYDROCUPREINS.

Preparation	Daily dose	Cases	Days treated	Number of parasitic failures
Hydroquinin (methylhydrocuprein) hydrochlorid	0·6-0·8 grm.	6	4-9	1
Ethylhydrocuprein (optochin) hydrochlorid	0·8-1·0 ,,	23	3-20	6
Isopropylhydrocuprein hydrochlorid or base	0·6-0·8 ,,	6	5-8	1
Isoamylhydrocuprein hydrochlorid or base	0·8-2·0 ,,	7	6-7	3

Baermann considered hydroquinin superior to quinin, *i.e.*, effective in smaller dosage, optochin about equal to quinin, the others inferior. Giemsa and Werner [16] also considered hydroquinin superior to quinin, as did MacGilchrist [17], but the statistics published to prove this point are not particularly extensive. Hydroquinin costs considerably more than quinin. Giemsa and Werner [16] considered quinidin (thirty-six cases) and hydroquinidin (thirteen cases) about equal to quinin. Cinchonin and hydrocinchonin they considered useless in doses up to 1 gram (15 grains) a day.

As will be shown later, cinchonin is not useless if the dosage be increased to 2-3 grams (30-45 grains) a day. MacGilchrist [17] found optochin inferior to quinin, cinchonin and quinidin.

Quitenin (see Table IV) is producible by the action of liver pulp on quinin [18]. It appears to be useless in malaria [16], even 30 grains (2 grams) in twenty-four hours [19]. Giemsa [20, 21] considers ethylquitenin as effective as quinin, and seems to regard aminohydroquinin quite as favorably. Quinicin (quinotoxin), an isomer of quinin in which a considerable molecular rearrangement has been produced, appears to be useless [22]. Quinicin is one of the "amorphous" alkaloids of cinchona febrifuge.

Alkaloids producible only by chemical synthesis cannot compete with quinin as antiperiodics unless their higher cost is outweighed by decisive therapeutic advantages. So far none has been definitely proved superior to quinin in any large-scale therapeutic comparison. There remain for consideration those natural alkaloids which cost about the same as quinin or a little less. It is important to examine their title to consideration as antiperiodics, and also interesting to review the history of cinchona bark itself.

Use of Cinchona Bark in Malaria.

It is not certainly known whether or not the Peruvians used cinchona bark in the treatment of intermittent fevers [10]. In 1630 Don Francisco Lopez Canizares, the Spanish *corregidor* of Loxa, now in Ecuador, is said to have been cured of a fever by the use of the bark [23]. In 1638, hearing of the illness of Ana de Osorio, wife of the Count of Chinchon, Viceroy of Peru, Canizares forwarded to the palace at Lima, 600 miles distant, a parcel of the bark [24]. Her physician, Don Juan De Vega, used it to cure her tertian fever. The next year it was in use in Spain. In 1670 the Jesuits forwarded parcels of bark to the Spanish Jesuit Cardinal Joannes de Lugo at Rome, and, being given away at his palace to the poor, it became known as "Cardinal's bark." In Brussels and Antwerp it received the name "Jesuit powder" because the Jesuits there gave it "without money and without price" to the poor who suffered from quartan fever. In 1669 it cost at Leipzig about 12 shillings ($2.92) an ounce [23], evidently a large sum for those times and probably representing at least a laborer's weekly wage. If the average alkaloidal content of the bark be taken as 5 per cent., and it be assumed that all would be completely extracted by the solvents then used, water or wine, it is clear that 30 grams (approximately an ounce) of the bark would yield about 1·5 grams or 22 grains of alkaloid, or only about enough to control the fever temporarily in each case. Such a conclusion appears in order from the work of Stephens and his collaborators. They have shown that in benign tertian malaria oral administration of quinine sulphate in doses of 10 grains (0·65 gram) on each of two consecutive days causes cessation of febrile paroxysms and effects the temporary

disappearance of all stages the of malarial parasite from the blood [25]. Five-grain (0·3 gram) doses are not adequate. If the dose is made larger, *e.g.*, 30 grains (2 grams), on each of the two days some cases do not relapse, but in one series of eighty-nine cases treated with 90-grain (6 grams) doses, eighty-four cases relapsed in twelve to fifty-three days [26]. A single dose of 120 grains represents approximately the limit of human endurance (collapse, temporary blindness, etc.) and does not obviate relapse [27].

The only species of cinchona bark which appears to have been imported into Europe prior to 1776 was the pale, Crown or Loxa (Loja) bark, of the species miscalled by Linnaeus in 1742 *Cinchona* (properly *Chinchona*) *officinalis* [3]. Analysis of the bark shows about the following proportions of alkaloids :

TABLE VI.—ALKALOIDS OF CINCHONA OFFICINALIS BARK [9].

Quinin	2·77-4·21 per cent.
Quinidin	0·16-0·22 ,, ,,
Cinchonin	0·85-1·57 ,, ,,
Cinchonidin	0·39-0·65 ,, ,,

The Jesuits appear to have adopted the following method of treating intermittent fevers [28]. A quantity corresponding to eight grams of the powdered chinchona bark was given immediately before the paroxysm was expected to begin, and the administration repeated until the patient recovered, the dosage being gradually reduced. Sydenham (1624-1689) started treatment immediately after the termination of the paroxysm and gave thirty-two grams, sometimes in two pounds of red wine, sometimes in " syrup of roses and pinks," in twelve divided doses at intervals in simple tertian fever of four hours. " Eight or fourteen days later, according to the type of the fever, he repeated the same dose : he likewise recurred several times to the same medication, particularly if the patient had long had the fever, and had suffered in constitution from paludal influence." Trousseau found this method much more efficacious than that of the Jesuits, and more protective against relapses ; vomiting and diarrhœa were, however, likely to occur, necessitating the addition of a little opium. Trousseau preferred " conserve of roses " or syrup of bitter orange as a vehicle for cinchona. The latter is still in occasional use with quinin. While the subject of vehicles is no longer a popular one for instruction in some of our great centres of medical learning, the story goes that it was to the happy discovery of the superior virtues of an infusion of cinchona bark in port wine that Robert Talbor rose to rank and wealth in the days of Sydenham.

" It was under this form that the celebrated empiric Talbor used to administer it in the paroxysm of the intermittents, and so successful was his practice, that Louis XIV was induced to purchase at a large price the secret of his specific ; and Charles the Second very unjustly protected him against the power of the College (Royal College of Physicians) and appointed him one of his physicians " [29].

After 1776, perhaps due to beginning exhaustion of the supply of bark near Loxa, other barks began to come on the market, yellow bark, chiefly probably *Cinchona calisaya*, the gray bark of *C. nitida*, and later *C. peruviana* and *C. micrantha*, and the red bark, probably of *C. succirubra*. While the yellow bark, later proved high in quinin content, quickly disputed the greatest popularity with the red and the crown barks, the gray barks, containing little or no quinin, were still considered valuable in the treatment of intermittent fever [30]. The table (VII) shows the proportions of the principal alkaloids in red bark and one of the gray barks.

TABLE VII.—ALKALOIDS OF C. SUCCIRUBRA AND C. MICRANTHA BARKS [9].

	Quinin	Quinidin	Cinchonin	Cinchonidin
Red bark—				
C. succirubra	1·38-2·30	—	1·16-2·28	1·14-2.06
C. succirubra (root bark) ..	1·24	0·41	0·77	1·43
Gray bark—				
C. micrantha	Possible trace	—	2·45	1·12-1·92

DISCOVERY OF THE CINCHONA ALKALOIDS.

Bernardino Antonio Gomez [31], a Portuguese naval surgeon, discovered in 1810 the first of the cinchona alkaloids to be separated from the bark, and named it cinchonin. Pelletier and Caventou [32], in 1820, isolated from yellow bark, quinin, from gray, cinchonin, and from red bark, quinin and cinchonin. Henry and Delondre [33] appear to be entitled to the credit for the discovery of quinidin (1833) although they abandoned their claim in 1834, and "deceived by the analogies between quinidine and quinine," pronounced it merely a "hydrate of quinine." Cinchonidin was discovered by Winckler in 1847 and named by him "quinidin," this name being free. Quinidin was rediscovered in 1849 by van Heyningen and named by him "β quinine." In 1853, "Pasteur, examining different samples of commercial quinidine sulphate, found that they contained two very distinct bases: one identical with the true quinidine of Henry and Delondre and with the β quinine of van Heyningen; the other presenting all the properties of the base discovered by Winckler" and then known also as quinidin. "For the first Pasteur kept the name of quinidine, after having established that it had the same composition as quinine, from which it differed in rotating polarized light to the right, instead of to the left as with quinine. The second base, which had the same composition as cinchonine, but was levo-rotatory, he called cinchonidine" [33]. Many authors refused to change the name of Winckler's quinidin to cinchonidin, and the German quinologist Hesse waited till 1873 to make the renunciation. Meanwhile confusion reigned in the nomenclature and troubles the reader of the present day who reviews the records of that time. The state of purity of the alkaloids was much inferior to the present, and in 1870 Clarke [34] said, "There is really very little quinine in general use that is not at present deeply adulterated with cinchonidine." Newton [35] confirmed this by publication of analyses by the New York pharmacist, Rice.

Since the time of Pasteur the existence in cinchona bark of a number of other alkaloids has been demonstrated. Of these the most important are the hydroalkaloids already mentioned. The physiological action of the latter, so far as known, appears to be very much the same as that of the related alkaloids. Thus hydroquinidin, which is a constant and practically irremovable impurity in medicinal quinidin, has, according to Lewis [36], practically the same action as quinidin in auricular fibrillation.

The Controversy as to the Comparative Values in Malaria of Quinin, Quinidin, Cinchonin and Cinchonidin.

In 1821, the year following that of the discovery of quinin, Chomel and Double compared the antiperiodic virtues of quinin and cinchonin, and concluded according to Silvestri [37] that cinchonin cures intermittent fever, but slowly and in larger dosage than is necessary with quinin. William Pepper [38], stated, however, that Bally, in 1825, using doses of 6-8 grains of cinchonin sulphate during the intermissions was able to check the fever by about four days of treatment in sixteen tertian, nine quotidian and two quartan fevers. Pepper (1853) used it with "signal success," and considered it equal to quinin. Turner [39] (1864) used it in 100 cases, usually in doses of 3 grains every hour to a total of 20 grains, and said "in slightly larger doses cinchonia is equal as an antiperiodic to quinia." Cinchonin then cost from one-half to one-tenth the price of quinin. Cinchonin still costs less than quinin (1929).

The failure, first of the Spaniards, and later of the South American countries concerned (Colombia, Ecuador, Peru, Bolivia) to restrain the improvident destruction of cinchona trees by the bark collectors, caused other nations anxiety lest the source of quinin should eventually dry up [23]. Various attempts were therefore made to set up the cultivation in other elevated tropical regions. Markham between 1859 and 1879 succeeded in introducing into India all the then-believed commercially valuable species, and about the same time the Java plantations, begun earlier by the Dutch, began to make good progress.

The Madras Chinchona Commission [40].

When Clements R. Markham had succeeded in establishing in the Nilgiri hills of Southern India the various species of cinchona obtained from South America, it was necessary to decide which tree had best be grown in large numbers as a source of antimalaria alkaloid, since the species differ (Tables I, VI and VII) in the sort of alkaloid which predominates in the bark. The Government of Madras Presidency was advised in 1866 by Dr. Shaw, Medical Inspector-General, to set up a medical commission to test the efficacy of cinchonidin, quinidin, and cinchonin as "cures for fevers," "on a scale sufficiently extensive to secure decisive results." The India office in London acquiesced, and instructed the firm of Howards to

prepare the sulphates of the four alkaloids. The Commission in their report speak of these alkaloids as chemically pure, which they were by the standards of the day. Howards (1929) surmise [6], from their knowledge of the alkaloidal separations then available, that the quinin used was probably free from cinchonidin, but would almost certainly contain hydroquinin; that the quinidin was almost certainly free from quinin, cinchonin and cinchonidin, but might contain anything up to 30 per cent. hydroquinidin as is true to-day with medicinal quinidin sulphate; that the cinchonin probably contained 10 per cent. hydroc nchonin; that the cinchonidin was "heavily contaminated" with quinin, of which it may even now readily contain 10 per cent.

The Madras Chinchona Commission was necessarily hampered by ignorance of the malarial parasite as the cause of malaria, and some of the patients may have been suffering from other fevers. Its work, however, was carried out on so great a number of fever patients, that, even if we consider only those patients who are classified as having suffered from tertian or quartan fevers, and therefore almost surely malarial, we yet have very conclusive evidence from their reports that all four of the alkaloids as tested are of a value in the treatment of malaria comparable to that of quinin. In 1867 they rendered a preliminary report on the treatment "mostly at stations notedly malarious" of 1,145 cases of "paroxysmal fevers." In 1868 they presented the main report on 2,472 further cases, saying "The fevers treated occurred chiefly at stations and in localities known to be malarious, . . . and may, therefore, be considered fevers of the true paroxysmal character caused by malaria." The results may be summarized as follows:

TABLE VIII.—MADRAS CHINCHONA COMMISSION—SUMMARY, 1867-68.

	Quotidian fever	Remittent fever	Tertian fever	Quartan fever	Total patients treated	Cured
Quinin ..	740	5	66	35	846	840 or 99·2 per cent.
Quinidin ..	942	8	80	10	1,040	1,025 or 98·5 ,, ,,
Cinchonidin	687	8	63	4	762	745 or 97·7 ,, ,,
Cinchonin	872	6	86	5	969	946 or 97·6 ,, ,,

The criterion of cure was "cessation of febrile paroxysms," which may, of course, occur without complete disappearance of malarial parasites from the blood.

The dose varied from 2 to 20 grains (quinin and cinchonidin), 2 to 30 grains (quinidin and cinchonin). The frequency of administration also varied. No treatment appears to have lasted longer than sixteen days.

The Commission ranked quinin and quinidin as of "equal febrifuge power," cinchonidin "only slightly less efficacious," cinchonin "considerably inferior to the other alkaloids" but "notwithstanding a valuable remedial agent in fever." Since the failures with any of the alkaloids might have been due to wrong diagnosis, or to insufficient dosage or

duration of treatment, their occurrence in greater number with cinchonin and cinchonidin might well have been a matter of chance.

The Commission obtained its published results by compilation of reports from twenty-six medical officers and subordinates, working in various localities considered malarious. Analysis of the report shows that certain reports might well be eliminated, e.g., that of one observer who, though he reported on two hundred cases, treated all with quinin. If we eliminate also all reports in which only two alkaloids were tried by the observer and those in which the report made on any alkaloid, except quinin, includes less than ten cases, we have left the most valuable part of the report, the work of nine observers on 2,717 cases out of a total of 3,617. Their results are presented in the table (IX), the localities in which they worked being

TABLE IX.—SUMMARY OF REPORTS OF THE NINE CHIEF OBSERVERS OF THE MADRAS CHINCHONA COMMISSION, 1867-1868.

Name	Localities	Quinin		Quinidin		Cinchonin		Cinchonidin		Total	
		Cured	Failed	Cured	Failed	Cured	Failed	Cured	Failed	Cured	Failed
Dr. Cleveland ..	Mysore	—	—	33	0	43	1	38	0	114	1
Dr. J. Dougall ..	Northern Circars, Jeypore	—	—	23	1	24	0	24	0	71	1
Dr. J. Fitzgerald ..	Labuan ..	36	0	109	0	89	8	82	3	316	11
Dr. Foy	Sumbulpore ..	—	–	42	1	38	0	39	2	119	3
Dr. J. M. Houston ..	Doomagoodiem, Upper Godavery	71	1	60	0	83	0	73	1	287	2
Dr. J. Keess and Assistant Apothecary M. Wade	Goodaloor (Wynaad)	307	1	416	2	447	2	366	0	1,536	5
Dr. D. J. McCarthy	Kurnool ..	—	—	31	0	32	0	32	0	95	0
Dr. G. E. Whitton ..	Cochin	38	0	34	1	45	0	37	1	154	2
Total	.. .. ..	452	2	748	5	801	11	691	7	2,692	25
Percentage cured ..	.. .. ..	99·5 °/₀		99·3 °/₀		98·7 °/₀		98·9 °/₀		99·0 °/₀	

given for reference. The reports of Keess and Wade, who worked at first together, are presented as one.

The table shows that these nine observers, with the exception of Fitzgerald, found but little difference in the antiperiodic power of the four alkaloids. Of Fitzgerald's eleven failures the Commission says "it is observed that in ten of these cases the paroxysms were checked by two and three 6-grain doses of quinine, and in one by two 12-grain doses of chemically pure quinine, by which the superior efficacy of quinine is evidently implied. It is necessary, however, to note that the fever-patients at Labuan were invariably given only a single 8 or 6-grain dose a few hours before the expected paroxysm, which we think can scarcely be deemed a quantity sufficient to check in every instance recurring febrile attacks of a paroxysmal nature."

The table also shows that Keess and Wade together treated over forty per cent. of the cases reported on, 1,541 out of 3,617. The Commission printed the brief report of each of these two in full, and they are here reproduced, because of the clinical details included.

REPORT ON THE CHINCHONA ALKALOIDS (TO THE MADRAS COMMISSION, 1867).

(By J. Keess, M.D., M.R.C.P.L.)

1. In obedience to instructions received from the head of the medical department, I proceeded to Goodaloor, South-east Wynaad, and started the alkaloids experiment on the 1st of June, 1866.

2. When I arrived at Goodaloor, fever was prevailing to a great extent, both there and in the adjoining coffee estates. Owing to the great rush of fever subjects to the dispensary, I decided on first observing the effects of large doses of the alkaloids.

3. As there were many persons suffering from fever in June, the administration of a single large dose enabled me to take up a larger number of cases than I would have been able to do had I begun with small and repeated doses.

4. I first tried chinchonidine, in doses varying from 10 to 15 grains, and in a few days I was pleased to find that it acted as quinine would have done in similar doses.

5. I next tried quinidine with similar results.

6. I left chinchonine to the last, as it was said to be an irritant of the gastro-intestinal mucous surface. I was, however, agreeably disappointed when I found that it did not cause nausea or vomiting in doses of 10 grains, and that it was as good an anti-periodic as the sister alkaloids.

7. Encouraged by the absence of symptoms indicating gastro-intestinal irritation, I used chinchonine in fever complicated with diarrhoea, and I am satisfied that it is not an irritant of the stomach or bowels, any more than quinine is, in certain cases.

8. Some of my patients were out- and in-patients of the Goodaloor dispensary. Others were visited in the bazaar, and in the adjoining coffee estates, from two to six miles distant from Goodaloor.

9. The great majority of my patients were half-starved emaciated persons, with flabby muscles, dry, dirty, and shrivelled skins, large spleens, bloodless eyes and tongue, and small atonic pulse. In many of them languor was so marked that they could with difficulty muster up energy enough to reply to questions ; and so prostrated were some of them, that they were with difficulty induced to take the medicines offered to them.

10. I have not attempted to reduce to a small compass the results set forth in the tabular reports, as I hear that this work has been undertaken by the Chinchona Commission, but I beg leave to point out that a 10-grain

dose of all three alkaloids seemed sufficient to check the return of fever in the majority of cases. Where it failed to check the return of fever, the succeeding paroxysm was generally observed to be less severe. When the paroxysms returned with unabated severity, 15 grains, and then 20 grains were tried. In a few severe cases I administered, at the onset, 15 or 20 grains.

11. During the four months that I was employed in the Wynaad, 467 cases were treated with the alkaloids. The majority of these were cases of the quotidian type. Bronchitis, congestion of the lungs, pneumonia, diarrhoea, dysentery, and anasarca were occasional complications. I may as well add, that these complications did not in the least interfere with the administration of the alkaloids. Where the local affection required special attention, the alkaloids were given with remedies suitable to the complication. I may here add, that all three alkaloids appeared to be as efficacious as quinine.

* * * * *

(signed) J. Keess, M.D., Assistant Surgeon, Late on Special Duty in the Wynaad.

Madras, 25 February, 1867.

WADE'S REPORT ON 1,079 CASES, TO THE MADRAS COMMISSION, 1868.

1. In forwarding the accompanying two tabulated sheets for the month of December, 1867, I beg to state that, in accordance with your instructions conveyed in Memorandum, No. 4591, the experiments with the alkaloids ceased on the 19th instant, owing to the last supply having been expended, and the report on its therapeutic properties as an anti-periodic is now submitted.

2. In the latter part of September, 1866, Assistant Surgeon J. Keess, who was specially employed on this duty, was removed to Madras. During the four months the experiments were carried on previous to his departure, the results proved so satisfactory that I was induced to continue them.

3. Since then, 1079 cases have been treated by these salts with success, as is shown in the accompanying general tabular statement.

4. *Disulphate of Quinine* (chemically pure).—The experiments connected with this salt are of a later date than the other alkaloids, having been put into practice in March last. The increase of the number treated over that of chinchonidine and chinchonine may be attributable to the fact that not only at the time of its introduction were paroxysmal fevers very prevalent, but its use was continued for a longer number of days monthly than the two above-named alkaloids. Out of 284 cases thus treated, one dose was sufficient to stay the attack of fever in 251 cases, while 32 required a second dose, and one solitary case complicated with congestion of left lung required the administration of a fourth dose.

5. *Quinidine.*—With this salt 300 cases have been treated, of which number one dose was sufficient in 268 cases, while 30 required a second

dose, and only two a third dose, so as to effectually stay the attack of fever. It exactly, not unlike quinine, dissolves with dilute sulphuric acid, and is very similar in its effects to that drug, if not equal to it.

6. *Chinchonidine.*—With this preparation 242 cases have been treated, one dose being sufficient in 219, while 21 had a second dose, and two a third dose. It, to some extent, creates nausea, and even induced vomiting in a few cases, leaving a disagreeable sensation for some time afterwards; nevertheless, its properties as an anti-periodic can be depended upon.

7. *Chinchonine.*—This salt was at first carefully and cautiously used, as I was led to believe that it was an irritant of the stomach and bowels, and though in a few cases vomiting was induced, and in others diarrhoea (doubtless quinine acting likewise in similar cases), yet its use proves that it is not a gastro-intestinal irritant. It has, in common with the other alkaloids, been used in cases complicated with diarrhœa and dysentery, in combination with laudanum, successfully: 253 cases were thus treated, 215 requiring one dose for their cure, while in 38 a second dose was administered.

8. *Decoction of Bark* was prepared with the dried leaves, twigs and bark of the chinchona plant as supplied by the superintendent of the Government Chinchona Plantation. It was continued for a couple of months only. Twenty-two cases were thus treated, in 20 of whom the attack was stayed, whilst in two it failed, quinine being resorted to. Of the two failures, one case of a month's duration, complicated with anasarca and general debility, may not be surprising; but the other, which was a mild attack and of short duration, yet derived no apparent benefit from the decoction, though it was steadily continued for five days. The dose usually administered was four ounces three times a day, and though the alkaloids effect a more speedy cure, which perhaps is more desirable with a working population, yet this simple anti-periodic can be obtained by the possessors of a few chinchona plants.

9. Chinchonine (cinchonism ?) was very generally complained of by the patients treated with the alkaloids, but it was apparent that it was more readily induced by the chemically pure disulphate of quinine and quinidine than by chinchonidine and chinchonine.

10. The alkaloids, not unlike quinine, have a tonic effect, helping digestion and increase of appetite.

11. The majority of the cases were out-patients of this dispensary, they were bad specimens for experimentary purposes, many being half-starved and emaciated, generally with enlarged spleens, a small weak pulse, invariably anaemic, and with marked pulsation.

12. Of the number treated, 87 were in-patients of this dispensary, and though they were for some time afterwards under treatment, either for other diseases or observation, they continued to remain free from fever while in hospital. Of the remaining number treated as out-patients, many were free from attacks, for long periods, enjoying good health, whilst many

again returned to the dispensary after the elapse of weeks for treatment for a second attack; but I submit that their return should be regarded more as a necessary consequence attributable to a continued residence in a notedly malarious climate, than to the inefficiency of the salts to stay the attack.

13. The alkaloids were generally administered in 10-grain doses dissolved in water—quinine and quinidine being soluble, chinchonidine and chinchonine partially so—each dose being invariably taken in my presence.

14. In conclusion, I would beg to state that, after a trial of 19 months with these salts in a malarious district, where paroxysmal fevers are very prevalent, a 10-grain dose of any of the alkaloids, as was usually given, tends either to cut short the attack of fever for some time, or mitigates markedly the severity of another paroxysm.

* * * * *

Even the most cursory examination of these reports of the Madras Chinchona Commission is sufficient to remove any doubt but that quinidin, chinchonin and chinchonidin (used like quinin) will terminate, except perhaps in a few instances, the febrile paroxysms of malaria as well as quinin. This report, however, received little circulation, being printed in an unwieldy government bluebook along with a mass of other information, chiefly regarding the chinchona plantations in India. Dougall [41] published a separate report on his seventy-two cases, but apart from this and brief mention in a few publications, the work has since dropped from sight so that only a few medical texts now even acknowledge its having been done, despite the considerable practical importance of the subject. Lauder Brunton [42] in 1885 said "The other cinchona alkaloids . . . , as also quinine, may be used as prophylactics in order to prevent the recurrence of ague in persons travelling through or living in malarious districts as well as for the purpose of curing malarious conditions already present."

Recent Comparisons of Quinin, Quinidin, Cinchonin and Chinchonidin.

Following the discovery of the malarial parasite, and the separation of malaria into simple (benign) tertian, malignant (tropical, aestivo-autumnal) tertian, and quartan fevers, further comparisons of the value of the alkaloids in the different types of malarial fever were naturally indicated, but it is only in comparatively recent years that these have been begun. They are not yet complete.

Some Early Observations.—Giemsa and Werner [14], using quinidin hydrochlorid in doses of 0·2 gram (3 grains) twice a day, found it to cause disappearance of malarial parasites in three days, and of the fever even more quickly. They found cinchonin hydrochlorid in doses of 0·2 gram

five times a day ineffective, but MacGilchrist [17] (1915) considered cinchonin most effective of the common cinchonin alkaloids. He carried out clinical investigation on adult male prisoners in two jails at Alipore in India. All were sick, and on examination showed the malarial parasite in the peripheral blood. Every eight hours a dose of the drug being tested was given in solution and a blood smear made for parasites. In a first series of seventy-two cases quinin, quinidin, cinchonidin and cinchonin sulphates were given in doses of 1 gram per 70 kilograms body weight or approximately 1 grain per 10 pounds body weight, or for a 150-pound man, 15 grains three times a day. Nine such consecutive doses were adequate in all cases, and with any of the four alkaloids, to cause disappearance of asexual parasites from the peripheral blood. Only two of the cases were quartan infections; in these the ninth dose was required to clear the blood, one treated with quinin being clear thirty-six hours after the ninth dose, and one treated with cinchonin being clear twenty-four hours after the ninth dose. It was difficult from this series to determine any advantage of one alkaloid over another.

In two further series MacGilchrist attempted to compare the rapidity of action of various cinchona alkaloids on the asexual parasites in very small doses proportioned to body weight. In this final series no drug appears to have been used in more than thirteen patients. He ranked the common alkaloids in order of effectiveness, the best first, cinchonin, quinin, quinidin (cinchonidin was tried on only three patients). But cinchonin sulphate, which he used, contains about 7 per cent. more alkaloid than quinin sulphate, and about 10 per cent. more molecules per gram weight. Hydroquinin hydrochlorid, which he considered even better than cinchonin, may also contain somewhat more alkaloid than quinin sulphate. His results hold good only on the basis that all these salts have the same percentage of alkaloid. In summary, he showed that all the common cinchona alkaloids are effective in clearing the peripheral blood of malarial parasites, as well as in subduing the fever, which latter had been proved by the Madras Commission.

Two patients were used as controls and received no antimalarial treatment; one of these, a sufferer from malignant tertian fever, got well in four days, a "spontaneous cure." MacGilchrist says, "This case is of importance in showing that the therapeutic value of these alkaloids cannot be gauged from one or two experiments only, as the protective forces of the patient occasionally aid the alkaloid greatly in its therapeutic effect." Such spontaneous cures (without treatment) have been noted by Yorke and MacFie [43].

Observations in Italy.—During the general upset of international commercial relations consequent upon the 1914-1918 struggle, the Italians found themselves for a time rather short of quinin, and turned to cinchonin particularly as a quinin substitute. Bini [44] describes an antimalarial campaign in which cinchonin sulphate was substituted for

nearly 40 per cent. of the total alkaloid, quinin forming the remainder. The results were good. Pontano [45] and Sanguinetti [46] considered cinchonin particularly valuable in cases where quinin could not be tolerated because of idiosyncrasy. As far as the general malaria problem was concerned, most appeared to consider cinchonin reliable in benign tertian and perhaps quartan fever, but not so good as quinin in malignant tertian fever. Sanguinetti [46], using Dionisi's scheme of quinin treatment, 6 x 1·6, 14 x 0·8, 60 x 0·4, where the first figure is days of treatment, the second dose in grams (1 gram = 15·6 grains), obtained in twelve soldiers cessation of fever with cinchonin treatment and no reappearance for twenty to twenty six days. All had benign tertian malaria. Silvestri [37] reviewed the literature on treatment of malaria, and stated that he had treated numerous cases of both benign and malignant tertian fever with cinchonin sulphate. He reported fourteen cases in detail. Amantea [47] reported good results in twenty-four cases treated with cinchonin, including all three types of malarial fever. He used two grams (30 grains) of cinchonin sulphate a day for as long as seventeen days without harm and found the drug well tolerated. Filipella [48] reported on twenty-three cases, using cinchonin in doses of 1 to 2·5 grams a day; he considered the remedy equal to quinin in benign tertian fever, but inferior to quinin in malignant tertian. Fiorentini [49] reported observations on the treatment of malaria in twelve children with cinchonin; he used as high as 0·5 gram (8 grains) in one day in a child of three and one-half months, 1·5 grams (23 grains) in a child of thirteen months. Such doses appear rather large in view of the adult daily dose of 1 to 3 grams. Fiorentini also found cinchonin easy to administer. Lega [50] has more recently (1928) compared cinchonin and quinidin. Using cinchonin sulphate in fifteen cases and quinidin sulphate in thirteen cases of benign tertian malaria he found the two of approximately equal value in terminating the fever and removing the parasites from the blood; the daily dose was 1 gram (15 grains) in each case. Using cinchonin in fifty-three cases and quinidin in twenty-seven cases of malignant tertian fever he found quinidin very reliable but cinchonin rather inferior; the daily dosage of quinidin sulphate was 1·5 grams (23 grains), and cinchonin sulphate had to be used in doses of at least 2 grams (30 grains) daily for good results, and even 2·5 to 3 grams (38 to 46 grains) was not always successful.

Observations in India.—Acton [51, 52] carried out observations at Dagshai Malarial Convalescent Depot (near Simla, N. India) a place 6,000 feet above sea level, where the possibility of reinfection was practically absent. The cases reported as "cured" showed no relapse within two months following cessation of treatment. Stephens [53] has found relapse to occur even four months after blood had become "negative" as a result of quinin treatment. The patients were British soldiers. Very few had malignant tertian malaria. All had had previous quinin treatment. Acton considers a single course of quinin more likely to be effective in malignant tertian than in benign tertian malaria.

The principal results are shown in the table.

TABLE X.—CINCHONA ALKALOIDS AND FEBRIFUGE IN CHRONIC BENIGN TERTIAN FEVER (ACTON, 1920), *cf.* TABLE XI.

Drug	Treated	Cured	Plan of treatment
Quinin (usually sulphate)	663	18-52·6 per cent.	Various, best by prolonged (4 months' oral treatment.
	190	42·1 ,, ,,	30 gr. a day for 10 days followed by iron and arsenic tonic for three weeks.
Quinidin sulphate ..	62	62·9 ,, ,,	10 gr. (0·6 grm.) twice a day for 21 days.
Cinchonidin sulphate ..	46	63·1 ,, ,,	As with quinidin.
Cinchonin	14	42·8 ,, ,,	Not stated.
Cinchona febrifuge ..	110	51·8 ,, ,,	21 gr. a day for 10 days (55), for 21 days (55).

These results have been widely quoted as showing a considerable superiority of quinidin over quinin in the treatment of benign tertian malaria. Later work has failed to support this conclusion.

Acton observed that patients relapsing have as good a chance of recovery on the next course of quinin as on the preceding course and are eventually cured.

Acton considered quinidin superior to quinin in benign tertian malaria. Sinton and Bird [54], however, were unable to confirm this. Following five years' work with 1,300 patients they say, "The four chief alkaloids showed almost an equal value in preventing relapse in chronic benign tertian malaria." The following, selected from their results for comparison of the effects of the alkaloids, bring out this point, and also show that the longer course of quinin gave better results. Their criterion of cure was absence of parasites in blood samples taken every week for eight weeks following cessation of all treatment.

TABLE XI.—CINCHONA ALKALOIDS AND FEBRIFUGE IN CHRONIC BENIGN TERTIAN FEVER (SINTON AND BIRD, 1929), *cf.* TABLE X.

Drug	Treatment	Treated	Cured *
Quinin sulphate	Various	601	30·6 per cent.
	30 × 14; 10 × 42 †	105	47 ,, ,,
	30 × 14; 20 × 7	72	30·6 ,, ,,
Quinidin sulphate	Various	194	15·5 ,, ,,
	20 × 28	16	31·3 ,, ,,
Cinchonin sulphate	20 × 28	69	31·9 ,, ,,
Cinchonidin sulphate	20 × 28	72	30·6 ,, ,,
	20 × 21	11	9 ,, ,,
Cinchona febrifuge	30 × 7; 20 × 21	67	25·4 ,, ,,

* Patients treated apparently successfully but not kept under observation would considerably raise this result. All such cases omitted from above table.

† 30 × 14; 10 × 42 means 30 gr. a day for 14 days followed by 10 gr. a day for 42 days.

The results of Sinton and Bird appear to dispose of Acton's idea that quinidin is preferable to quinin in benign tertian fever. In similar dosage and duration of administration all of the alkaloids appear to have the same efficiency. The results with quinin are evidently improved by prolonging the period of ingestion of small doses. It is unfortunate that this was not also done with the other alkaloids for comparison. No superiority of

chinchona febrifuge is demonstrated. Its composition is quite variable (Table II).

The Cuyamel Campaign.—The desirability of a more lengthy administration rather than huge dosage of alkaloid in malaria can be seen from Barlow's [55] figures for the results of an antimalarial campaign in the coastal plains of Honduras, in which the New Orleans malariologist, Dr. C. C. Bass, was consultant. Barlow used 5 grain (0·3 gram) capsules of quinin bisulphate which contains about 60 per cent. of quinin. Following a preliminary laxative he gave 20-30 grains a day (1·3-2 grams) for two or three days, 15 grains daily (1 gram) for one month, then 15 grains twice a week for two months more. Five hundred and eighty of his patients could be watched for three to six months after treatment was concluded. Reinfection could not be excluded. The results were, however, good :—

TABLE XII.—QUININE IN MALIGNANT TERTIAN MALARIA.

Number of patients	Duration of treatment	Relapses	Percentage cured
116	Less than one month	116	0 per cent
246	One month	91	63 ,,
218	Three months	0	100 ,,

Observations in Malaya.—William Fletcher [56] of the Institute for Medical Research of Kuala Lumpur, Federated Malay States, has recently published a very valuable work which is a mine of information for anyone interested in the treatment of malaria. He reviews carefully the use and abuse of quinin by all methods of administration and gives his own acute personal observations. Fletcher has also made comparisons of the action of the four main cinchona alkaloids on the fever and the parasites in malaria, working with all three types of malaria.

No brief summary will be attempted of Fletcher's work, but some of his conclusions may be briefly given. He states, "In doses of ten grains twice a day, the four crystallizable alkaloids, quinine, quinidine, cinchonine and cinchonidine, appeared to be of equal value in bringing about the disappearance of malaria parasites, in patients weighing about 100 lb. None of these alkaloids produced toxic symptoms when they were administered in this quantity. In small doses of five grains a day, cinchonine did not appear to be quite so potent as the sulphates of quinine and quinidine. Cinchonidine sulphate was definitely inferior to the other crystalizable alkaloids, when given in small doses. The results of quinidine sulphate in quartan malaria were slightly better than those of quinine sulphate. Quinoidine, in doses of five grains a day, did not cause the disappearance of malaria parasites from the blood. Ten-grain doses are too toxic to be employed in the treatment of malaria."

Because of the allegation that cinchonin was poisonous Fletcher made a special investigation of its action on twenty-five patients with tertian, subtertian fever or mixed tertian fever. He says, "Cinchonine did not

cause any unpleasant symptoms when it was given at the rate of 0·1 grain per pound (about 10 grains): if anything, it proved slightly less toxic than quinine. Five of the patients were vomiting occasionally when they began to take the drug, but the vomiting ceased after a day's treatment. Three patients had slight diarrhœa. One man had albuminuria when he came into the hospital, but it disappeared after he had been taking cinchonine for four days." An average dose of 20 grains (1·3 grams) twice daily to men weighing about 100 pounds caused giddiness. "One vomited and one complained of his sight, but the symptoms were certainly no worse than they would have been with quinine."

Substitution of other Cinchona Alkaloids in Cases of Quinin Idiosyncrasy.

A small number of cases are on record of patients who were unable to take quinin because it produced urticaria, dyspnœa, dermatitis, hemoglobinuria, etc., but were able to take quinidin or cinchonin. Giemsa and Werner [14] reported the successful substitution of quinidin. Dawson and Garbade [57] have recently reported a case of idiosyncrasy to seven levorotatory cinchona alkaloids, including quinin, cinchonidin, optochin, but not extending to the dextrorotatory isomers, quinidin, cinchonin, optochidin, etc. Fletcher [56], Fletcher and Travers [58], and Mariani [37], and Ascoli [37] have reported cases of quinin idiosyncrasy successfully treated with cinchonin. Moreschi [59] however, has reported a case of quinin hemoglobinuria, in which cinchonin was at first successfully substituted, but after some weeks also caused hemoglobinuria, as did later quinidin and optochin.

Mode of Action of Cinchona Alkaloids in Malaria.

The mechanism or chain of events by which a cinchona alkaloid may produce a cure in a case of malaria is unknown. Excellent discussions are given by Yorke and MacFie [43], Lipkin [18], and by Giemsa [60]. It seems certain that the mode of action of cinchona alkaloids is complex and involves some alteration, not only in the viability of the malarial parasite more or less indirectly, but also in the body cells or fluids. As Yorke and MacFie point out, spontaneous recovery from malaria or development of tolerance to the presence of small numbers of parasites, must often occur, or the mass of the native population in the tropics would be exterminated. The factor of resistance to the infection on the part of the patient therefore must be important.

In the case of quinin the active curative agent is probably either quinin itself, or the intermediate aldehyde [18], quininal [10], since the next oxidation product, quitenin, appears inactive [16] [19]. The highest blood quinin concentration likely to be maintained by most massive dosage is probably about 1:60,000 [61]. Kirschbaum [62] found tertian (*P. vivax*) [2] parasites incubated 5-24 hours with quinin 1:10,000 still

capable of producing malarial infection in six paretics. The action of quinin is therefore probably indirect. Bass [63] found *P. falciparum* succumb in 29 hours to incubation with quinin about 1 : 3,500, but such a concentration is unlikely to be obtained in the human blood-stream by any means compatible with the survival of the patient.

Military Importance of Quinin.

The restrictions, which it was necessary to apply to quinin distribution during the Great War, show that it would be wise for every power which has a malaria problem, to have under its firm control sources of quinin, including plantations in its sphere of influence, quinin works and adequately trained cinchona chemists, as measures of military protection. Since this is clearly impossible for many powers deeply concerned, it is to be hoped that friendly adjustments may be made possible, in mercy to mankind.

Conclusions.

Malaria appears to be curable by the administration of any one of quite a large number of cinchona alkaloids. None of these has been definitely proved superior to quinin. Only quinin, quinidin, cinchonin and cinchonidin are sufficiently cheap to be worthy of practical consideration in connection with the treatment of malaria.

Complete comparisons of the value of each of these four alkaloids in all three types of malaria have not yet been made. Quinin cures all types. In benign tertian malaria all four are possibly of equal value. Quinin appears extremely effective in malignant tertian (subtertian) malaria. Quinidin is more effective in malignant tertian malaria than is cinchonin. Quinin and quinidin are probably of equal value in quartan malaria.

There is no clear evidence that quinidin, cinchonidin or cinchonin is more toxic to man than is quinin. Therefore the dosage of quinidin, cinchonidin or cinchonin in malaria would be the same as of quinin, *e.g.* 10 grains (0·65 gram) of the sulphate twice or three times a day initially, for the average adult.

Quinidin or cinchonin may sometimes be successfully used to replace quinin in malaria where quinin idiosyncrasy hinders or prevents administration of quinin. Of these two substitutes quinidin would probably be preferable in malignant tertian fever.

REFERENCES.

[1] Cowan, J. M. "Cinchona in the Empire. Progress and Prospects of its Cultivation," *Empire Forestry Journal*, 1929, vol. viii, pp. 45-53.

[2] Chininum, 1924. Bureau for Increasing the Use of Quinine, 48, de Wittenkade, Amsterdam, Holland.

[3] Markham, Clements Robert. "Peruvian Bark," John Murray, London, 1880.

[4] Howard, David. "Cinchona Barks and their Cultivation," *Journ. Soc. Chem. Ind.*, 1906, vol. xxv, pp. 97-100.

[5] Discussion on Cinchona Alkaloids and Malaria, *Trans. Roy. Soc. Trop. Med. and Hyg.*, 1924-25, vol. xviii, pp. 358-369.

[6] Howards and Sons, Messrs., Ltd. Personal communication.
[7] Grant, R. T., and Iliescu, C. C. "Comparison of the Action of Quinidine with Other Cinchona Alkaloids in Auricular Fibrillation," *Heart*, 1921-22, vol. ix, pp. 289-296.
[8] Amsterdamsche Chinine-Fabriek. Personal communication.
[9] Chick, Oliver. "Cinchona Alkaloids, Allen's Commercial Organic Analysis," vol. vii, "Vegetable Alkaloids," Fifth Edition, P. Blakiston's Son and Co., Philadelphia, 1929.
[10] Henry, Thomas Anderson. "The Plant Alkaloids," 2nd Edition, P. Blakiston's Son and Co., Philadelphia, 1924.
[11] Grimaux, E., et Laborde, J.-V. "Note préalable sur la cupréine et ses dérivés; chimie et physiologie," *Compt. rend. Soc. de Biol.*, 1892, vol. xliv, pp. 608-613.
[12] Grimaux, E., Laborde et Bourru. "Sur les homologues de la quinine; leur action physiologique et thérapeutique," *Compt. rend. Acad. des Sciences*, 1894, vol. cxviii, pp. 1303-1306.
[13] Laborde, Grimaux, E. et Bourru. "Sur l'action physiologique et thérapeutique des homologues de la quinine: Cupréine, Quinéthyline, Quinopropyline," *Bull. de l'Acad. de Méd.*, 1894, vol. xxxii, pp. 25-45.
[14] Giemsa, G., und Werner, H. "Erfahrungen mit weiteren dem Chinin nahestehenden Alkaloiden, und einigen ihrer Derivate bei Malaria (Chinidin, Hydrochinidin, Cinchonin, Hydrocinchonin, Cuprein, Chinäthylin und Chinopropylin)," *Arch. f. Schiffs- und Tropen-Hyg.*, 1914, vol. xviii, pp. 12-15.
[15] Baermann, G. "Zur Wirkung des Hydrochinin und seiner höheren Homologen (Äthylhydrokuprein u. a.) bei Malaria," *Arch. f. Schiffs- und Tropen-Hyg.*, 1914 vol. xviii, pp. 293-306.
[16] Giemsa, G., und Werner, H. "Erfahrungen mit einigen Derivaten des Chinins (Aurochin, Chitenin, Dihydrochinin, Tetrahydrochinin) bei Malaria," *Arch. f. Schiffs- und Tropen Hyg.* (Beihefte), 1912, vol. xvi, pp. 65-89.
[17] MacGilchrist, A. C. "The Relative Therapeutic Value in Malaria of the Cinchona Alkaloids—Quinine, Cinchonine, Quinidine, Cinchonidine and Quinoidine, and the Two Derivatives, Hydro-Quinine and Ethyl-Hydro-Cupreine, *Ind. Journ. Med. Research*, 1915-16, vol. iii, pp. 1-89.
[18] Lipkin, I. J. "On the Distribution and Destruction of Quinine in Animal Tissues," *Ann. Trop. Med. and Parasitol.*, 1919-20, vol. xiii, pp. 149-176.
[19] Stephens, J. W. W., Yorke, W., Blacklock, B., MacFie, J. W. S., and O'Farrell, W. R. "Studies in the Treatment of Malaria; XXVIII—Quitenine Hydrochloride in Simple Tertian Malaria," *Ann. Trop. Med. and Parasitol.*, 1919-20, vol. xiii, pp. 117-118.
[20] Giemsa, G., Weise, W., und Tropp, C. "Chemotherapeutische Studien mit Vögelmalaria, (Plasmodium præcox)," *Arch. f. Schiffs- und Tropen-Hyg.*, 1926, vol. xxx, pp. 334-347.
[21] Giemsa, G. Über Zwei in chemotherapeutischer Beziehung beachtenswerte Derivate des Chinins (Aminohydrochinin, Chitenin äthylester)," *Arch. f. Schiffs- und Tropen-Hyg.*, (Beihefte), 1926, vol. xxx, pp. 62-67.
[22] Stephens, J. W. W., Yorke, W., Blacklock, B., MacFie, J. W. S., Cooper, C. Forster, and Carter, H. F. "Studies in the Treatment of Malaria: XVII—Oral Administration of Quinotoxin for Two Consecutive Days Only in Simple Tertian Malaria," *Ann. Trop. Med. and Parasitol*, 1918-1919, vol. xii, pp. 217-222.
[23] Flückiger, Friedrich A., and Hanbury, Daniel. "Pharmacographia," 2nd Edition, Macmillan and Co., London, 1879.
[24] Gage, A. T. "Note from a Cultural and Commercial Point of View on the Use of Cinchona Alkaloids in the Treatment of Malaria," *Trans. Roy. Soc. Trop. Med. and Hyg.*, 1924-25, vol. xviii, pp. 345-352.
[25] Stephens, J. W. W., Yorke, W., Blacklock, B., MacFie, J. W. S., Cooper, C. Forster, and Carter, H. F. "Studies in the Treatment of Malaria: VI—Oral Administration of Quinine for Two Consecutive Days Only, in Simple Tertian Malaria," *Ann. Trop. Med. and Parasitol*, 1917-18, vol. xi, pp. 283-307.
[26] Stephens, J. W. W. and Others. "Studies in the Treatment of Malaria: XIII—Oral Administration of Quinine Sulphate Grains 90 on Two Consecutive Days Only, in Simple Tertian Malaria (Second Series)," *Ann. Trop. Med. and Parasitol.*, 1918-19, vol. xii, pp. 71-73.

[27] STEPHENS, J. W. W., and OTHERS. "Studies in the Treatment of Malaria: X—Oral Administration of Quinine Sulphate Grains 120 on Two Consecutive Days Only, in Simple Tertian Malaria," *Ann. Trop. Med. and Parasitol.*, 1917-18, vol. xi, pp. 417-419.

[28] TROUSSEAU, A. "Lectures on Clinical Medicine," vol. v, lecture 35, New Sydenham Society, London, 1872. Translation from 1868 Edition.

[29] PARIS, J. A. "Pharmacologia," 3rd American Edition, 1828.

[30] PEREIRA, JONATHAN. "The Elements of Materia Medica and Therapeutics," vol. ii, part II, 4th Edition, Longman, Brown, Green, Longman and Roberts, London, 1857.

[31] GOMEZ, BERNARDINO ANTONIO. "Ensaio sôbre o cinchonino e sôbre sua influencia na virtude da quina e d' outras cascas," *Memorias da Academia Real das Sciencias de Lisboa*, 1812, vol. iii, p. 202 (quoted by Pereira [30]).

[32] PELLETIER ET CAVENTOU. *Journ. de Pharm.*, 1821, vol. vii, p. 89 (quoted by Pereira [30]).

[33] LEGER, E. "Les Alcaloïdes des Quinquinas," *Soc. d'Éditions Scientifiques*, Paris, 1896.

[34] CLARKE, C. B. *Madras Monthly Journ. Med. Sci.*, 1870, vol. i, p. 426.

[35] NEWTON, William K. "The Other Cinchona Bases Compared with Quinia," *Med. Rec.*, 1878, vol. xiii, pp. 266-269.

[36] LEWIS, T., DRURY, A. N., WEDD, A. M., and ILIESCU, C. C. "Observations upon the Action of Certain Drugs upon Fibrillation of the Auricles," *Heart*, 1921-1922, vol. ix, pp. 207-267.

[37] SILVESTRI, SILVESTRO, "La cinconina nella cura della malaria," *Policlin. (sez. med.)*, 1921 vol. xxviii, pp. 529-545.

[38] PEPPER, WILLIAM. "On the Use of Bebeerine and Cinchonia in the Treatment of Intermittent Fever," *Am. Journ. Med Sci.*, 1853, vol. xxv, pp. 13-25.

[39] TURNER, A. PAUL. "Observations upon One Hundred Cases of Intermittent Fever in which the Sulphate of Cinchonia was used as a Substitute for Quinia," *Am. Journ. Med. Sci.*, 1864, vol. xlvii, pp. 396-404.

[40] Reports of the Madras Chinchona Commission, 1867 and 1868. "Return (of all correspondence relating to) East India (Chinchona Cultivation), April 1866 to April 1870." Printed August 9, 1870. H.M. Stationery Office, London. Obtained for me through the kindness of Messrs. Howards [6].

[41] DOUGALL, JOSEPH. "The Febrifuge Properties of the Cinchona Alkaloids—Cinchonia, Quinidia, and Cinchonidia," *Edinburgh Med. Journ.*, 1873, vol. xix, pp. 193-209.

[42] BRUNTON, T. LAUDER. "Pharmacology, Therapeutics and Materia Medica," 2nd Edition, 1885.

[43] YORKE, WARRINGTON, and MACFIE, J. W. S. "Observations on Malaria Made during Treatment of General Paralysis," *Trans. Roy. Soc. Trop. Med. and Hyg.*, 1924, vol. xviii, pp. 13-33.

[44] BINI, GUIDO. "La cinconina puo sostituire la chinina," *Policlin., sez. prat.*, 1921, vol. xxviii, p. 919.

[45] PONTANO, TOMMASO. "Esame delle più importanti acquisizioni fatte durante la guerra nel campo della malaria," *Policlin. sez. med.*, 1920, vol. xxvii, pp. 225-255.

[46] SANGUINETTI, A. "Cinconina e malaria," *Policlin. sez. prat.*, 1921, vol. xxviii, pp. 1652-1653.

[47] AMANTEA, FAUSTO. "Il potere curativo della cinconina nella malaria," *Policlin. (sez. prat.)*, 1922, vol. xxix, pp. 1231-1235.

[48] FILIPELLA, PIETRO. "Contributo allo studio sulla terapia della malaria con la cinconina," *Policlin. sez. prat.*, 1923, vol. xxx, pp. 464-470.

[49] FIORENTINI, AUGUSTO. "La cinconina nella cura della malaria dei bambini," *Policlin. (sez. prat.)*, 1923, vol. xxx, pp. 1025-1031.

[50] LEGA, G. "Il chineto, la cinconina, la chinidina nella cura della malaria," *Riv. di Malariolog.*, 1928, vol. vii, pp. 629-658.

[51] ACTON, HUGH W. "Researches on the Treatment of Benign Tertian Fever," *Lancet*, 1920, vol. i, pp. 1257-1261.

[52] ACTON, HUGH W. and Others. "The Diagnosis and Treatment of Benign Tertian and Malignant Tertian Fevers" (series of articles), *Indian Journ. Med. Research*, 1921, vol. viii, pp. 750-865.

[53] STEPHENS, J. W. W., YORKE, W., BLACKLOCK, B., MACFIE, J. W. S., COOPER, C. FORSTER, and CARTER, H. F. "Studies in the Treatment of Malaria: XII—At What Time After Cessation of Quinine Treatment Do Relapses Occur in Simple Tertian Malaria," *Ann. Trop. Med. and Parasitol.*, 1918, vol. xi, pp. 425-441.

[54] SINTON, J. A., and BIRD, W. "The Cinchona Alkaloids in the Treatment of Benign Tertian Malaria," *Indian Journ. Med. Research*, 1929, vol. xvi, pp. 725-746.

[55] BARLOW, N. "Clinical Report of the Antimalarial Campaign at Cuyamel," *Amer. Journ. Trop. Dis. and Prev. Med.*, 1915, vol. ii, pp. 585-596.

[56]. FLETCHER, WILLIAM. "Notes on the Treatment of Malaria with the Alkaloids of Cinchona," John Bale, Sons and Danielsson, Ltd., London, 1928.

[57] DAWSON, W. T., and GARBADE, FRANCIS A. "Idiosyncrasy to Quinine, Cinchonidine and Ethylhydrocupreine and other Levorotatory Alkaloids of the Cinchona Series," *Journ. Amer. Med. Assoc.*, 1930, vol. xciv, pp. 704-705.

[58] FLETCHER, WILLIAM, and TRAVERS, E. A. O. "Quinine Idiosyncrasy and Cinchonine,' *Brit. Med. Journ.*, 1923, vol. i, pp. 629-630.

[59] MORESCHI, CARLO. "Contributo allo studio della emoglobinuria nei malarici (emoglobinuria da chinina e cinconina)," *Policlin. (sez. med.)*, 1920, vol. xxvii, pp. 216-224.

[60] GIEMSA, G. "Ueber den Mechanismus der antimalarischen Chininwirkung," *München. Med. Wochnschr.*, 1927, vol. lxxiv, pp. 574-577.

[61] RAMSDEN, W., LIPKIN, I. J., and WHITLEY, E. "On Quinine in Animal Tissues and Liquids, with Methods for its Estimation," *Ann. Trop. Med. and Parasitol.*, 1918-19, vol. xii, pp. 223-258.

[2] KIRSCHBAUM, WALTER. "Methoden und Kautelen einer Malaria-blutkonsewierung und-versendung zur Behandlung der progressiven Paralyse nach Beobachtungen an Tertiana-plasmodien *in vitro* und an Impfoersuchen," *Klin. Wchnschr.*, 1923, vol. ii, pp. 1404-1406.

[63] BASS, C. C. "Some Observations on the Effect of Quinine Upon the Growth of Malaria Plasmodia *in vitro*," *Amer. Journ. Trop. Med.*, 1922, vol. ii, pp. 289-292.

THE KAHN TEST.—A COMPARISON WITH THE WASSERMANN (2,300 SERA).

By Major C. H. K. SMITH, M.C.,
Royal Army Medical Corps,

AND

Assistant Surgeon N. A. MICHAEL,
Indian Medical Department.

During the past three years the Punjab winter has been responsible for considerable losses amongst our guinea-pig stock, causing such reduction that difficulty in carrying out the Wassermann tests was experienced.

Accordingly, we decided to turn our attention to one of the flocculation tests for syphilis, such tests having the great advantage of only requiring one reagent apart from the patient's serum. The Kahn test, having been reported upon so favourably in very large numbers of cases and having replaced the Wassermann test in many of the large centres, more particularly in America, was the test chosen by us for trial.

For comparison purposes, both the Wassermann and the routine Kahn tests were carried out on 2,300 sera with results described later. The technique of the Wassermann used was that described as No. 1 Method in the Medical Research Committee's Special Report, Series No. 14 (1918), while for the flocculation test, Dr. Kahn's Routine Test was the one adopted.

Antigen may either be purchased from Parke, Davis and Co., standardized and ready for use, or can be prepared locally. The Parke, Davis antigen is supplied in ten cubic centimetre phials at a cost of approximately seventeen rupees, and this suffices for about 200 tests. We calculated that antigen prepared by us in the laboratory did not cost more than eight annas per ten cubic centimetres, a considerable saving. Both antigens have been used by us in this investigation, and although the Parke, Davis product appeared slightly more sensitive, we found the "home-made" antigen gave quite satisfactory readings.

The following method was adopted in recording the results of the test :—

A heavy precipitate in one or more tubes was considered	positive (+)
A fine granulation in two tubes	negative incomplete (±)
Opalescence in all tubes with no granules visible with hand lens	negative (−)

COMPARATIVE WASSERMANN AND KAHN RESULTS (2,300 SERA).

Type of case	Agreements		Disagreements				
	Positive	Negative	W + K −	W + K ±	W − K +	W − K ±	W ± K +
S_1A	135	17	..	..	..	28	19
S_2A	224	..	..	..	..	..	..
S_3A	36	..	4	..	..	..	..
S.P.	507	448	5	..	4	9	23
Non-venereal	..	427	..	..	..	..	..
Venereal sore	..	394	..	..	..	..	..
Congenital	2	..	..	..	..	..	..
Gonorrhœa	..	12	..	..	..	..	..
Leprosy	..	6	..	..	..	..	..
Total ..	904	1,304	9	..	4	37	42
	2,208		92				

Grand total 2,300
Total agreements .. .. 96 per cent
Total disagreements .. .. 4 per cent

S_1A = Primary syphilis case before treatment.
S_2A = Secondary syphilis case before treatment.
S_3A = Tertiary syphilis case before treatment.
S.P. = Syphilis case during or after treatment.

NOTES ON CASES SHOWING DISAGREEMENT.

A. *Primary Syphilis before Treatment* (S_1A).

(*a*) Wassermann reaction .. negative } 28 cases
Kahn reaction .. .. negative incomplete }

In ten cases *Treponema pallidum* was found, and the Wassermann and Kahn reactions both became positive later.

In the remaining cases (eighteen), after repeated scrapings, no *T. pallidum* was found. The diagnosis of these cases, however, was made on the fact that both Wassermann and Kahn reactions became positive later on, the Kahn reaction tending to become positive rather earlier than the Wassermann.

(*b*) Wassermann reaction .. negative incomplete } 19 cases
Kahn reaction .. .. positive }

In seven cases *T. pallidum* was found, and both Wassermann and Kahn reactions gave positive readings later.

In twelve cases no *T. pallidum* was found, but in later tests the Wassermann became positive and established the diagnosis.

Analysis of the above forty-seven cases seems to demonstrate that in early primary syphilis, before treatment, the Kahn test is more sensitive, appearing earlier in the disease than the Wassermann.

B. *Tertiary Syphilis before Treatment* (S_3A).

Wassermann reaction .. positive } 4 cases
Kahn reaction .. .. negative }

Two cases gave history of persistent headache, one case vague pains in joints, one case was a suspected G.P.I.

These cases were diagnosed on repeated Wassermann-positive reactions.

C. Syphilis Cases during and after Treatment (S.P.).

(*a*) Wassermann reaction	..	positive	5 cases
Kahn reaction ..	..	negative	

These five cases, in spite of prolonged treatment, remained Wassermann-fast throughout.

(*b*) Wassermann reaction	..	negative	4 cases
Kahn reaction ..	..	positive	

These cases remained Kahn-positive throughout.

(*c*) Wassermann reaction	..	negative	9 cases
Kahn reaction ..	..	negative incomplete	
(*d*) Wassermann reaction	..	negative incomplete	23 cases
Kahn reaction ..	..	positive	

The above cases in (*b*), (*c*) and (*d*) demonstrate that the Kahn reaction was stronger than the Wassermann during or as result of treatment.

In addition to the above, disagreements were also noted with "septic" sera, the impression being that a positive Wassermann reaction was more likely to be caused by sepsis than a positive Kahn reaction.

Summary.

(1) Wassermann and Kahn tests have both been carried out on 2,300 sera for comparison purposes.

(2) The results show ninety-six per cent agreements and four per cent disagreements.

(3) An analysis of those cases showing disagreement is given.

(4) The Kahn reaction appears to become positive earlier in the disease, and it persists longer during treatment than is the case with the Wassermann.

Conclusions.

Although it is considered that the Wassermann reaction still remains the "final court of appeal," the Kahn test has proved a most reliable substitute.

Its extreme simplicity and the fact that it does not require any elaborate apparatus or animals allow of its being carried out in small laboratories.

Should "decentralization" of the laboratory control of V.D. be contemplated, the Kahn test is the test of choice. In the present system, however, where certain large laboratories are charged with these duties, we prefer to think that the most reliable diagnosis will be obtained if the two tests are considered in parallel.

Editorial.

THE STATE OF THE PUBLIC HEALTH

In the editorial published in the February number of the Journal we dealt with several important sections of Sir George Newman's Report on the State of the Public Health. This month we shall give brief notes on tuberculosis, cancer, food in relation to health, work in the Ministry's laboratories, medical intelligence, International Health, and the medical aspects of the Local Government Act.

The notification of tuberculosis is becoming more effective year by year, but early diagnosis is essential if preventive measures are to have a chance of success. Tuberculosis officers and medical officers of health in the large industrial areas of the North and Midlands find that the working man struggles on in the early stages of the disease and will not consult a doctor for fear of losing his employment. In the South Shields County Borough the figures showed that two-thirds to three-quarters of the patients died before there was a reasonable opportunity of doing anything for them in the way of treatment or prevention. Sir George Newman says the only remedy is for the local authority to institute propaganda, which they are empowered to do by the Public Health Act of 1925. The diffusion of knowledge respecting the facilities for the treatment and diagnosis of tuberculosis is essential and general practitioners should be reminded that it is their duty to notify tuberculosis.

The deaths from tuberculosis rose from 29,799 in 1928 to 31,435 in 1929. This increase is considered to be mainly due to the outbreak of influenza in the spring of 1929.

The Ministry of Health has approved 498 institutions containing 23,549 beds for the treatment of tuberculosis. On April 1, 1930, tuberculosis work was being done in 461 dispensaries and in addition 97 other premises were approved for special forms of treatment including orthopædic.

The ratio of new cases and contacts dealt with to the deaths from tuberculosis is steadily increasing in the Provinces but remains stationary in London. Consultations between general practitioners and tuberculosis officers are increasing and fewer patients remain undiagnosed for long periods. Provision of apparatus for radiographic examination is now considered essential for tuberculosis dispensaries.

There has been a tendency to prolong the stay in institutions of cases which are not likely to become arrested; for these admissions for short periods of treatment repeated at intervals, seem more suitable.

The great difficulty is to retain the curable patients for sufficient time. The number of these staying in institutions for six months is far too small.

As a result of treatment in resident institutions the disease was regarded as quiescent in 18·8 per cent of the pulmonary cases. This figure at first sight does not appear very satisfactory, but it must be remembered that many of the cases were admitted too late for effective treatment. In the County of Lancashire where there is a proper selection of cases for sanatorium treatment the results are more encouraging. In 1928, 715 cases of pulmonary tuberculosis were treated in sanatoria, and of these 445 or 30·8 per cent were discharged as quiescent.

During 1928, 10,207 former cases of pulmonary tuberculosis which had shown neither symptoms nor physical sign of disease for five years were regarded as cured and removed from the dispensary registers. During the year 189 cases which had previously been regarded as cured were restored to the registers for further treatment or observation. It is impracticable to give any accurate opinion as to the number of cases believed cured which relapse at a later date. The number appears to be small and the Ministry seem to be justified in their definition as to what, for practical purposes, may be regarded as a cure.

Provision for the treatment of surgical tuberculosis forms an essential part of a Tuberculosis Scheme. Intensive studies of surgical tuberculosis have been made by Gauvain at Alton and Rollier at Leysin. They have shown that by good food, open-air treatment, exposure to sunlight and by immobilization, cures can be obtained, and that operative treatment should be the exception and not the rule.

Sir Robert Jones and his pupils organized schemes for the orthopædic treatment of all forms of crippling, including surgical tuberculosis, first at Baschurch and later at Oswestry. They made provision for expert diagnosis, immobilization in special institutions situated in the open country and for after-care in clinics, or at the patient's home. Girdlestone developed a scheme for orthopædic treatment for Oxfordshire and the neighbouring counties directly out of the Military Orthopædic Hospital established at Headington, Oxford, during the war.

This new work stimulated Local Authorities to make provision for the treatment of surgical tuberculosis and since the beginning of the year 1927, the Ministry have approved schemes from 30 Local Authorities, so that now 29 Counties and 34 County Boroughs have comprehensive orthopædic schemes.

The Ministry regard Village Settlement Schemes as essential for the carrying out of the after-care of cases of tuberculosis who have received treatment in sanatoria. They made money grants to Papworth, the first Village Settlement established in this country, and to Preston Hall, established for ex-service men and now taken over by the British Legion, and they encouraged the progress of Borrowmore in Cheshire, a small colony set up by a voluntary committee. It is anticipated that Local Authorities, with the greater freedom they will enjoy under the Local Government Act of 1929, will pay more attention to this important subject.

In 1881 Creighton drew attention to bovine tuberculosis in man, and since then this type of pulmonary tuberculosis has been regarded as a curiosity of little practical importance. Park and Krumweide recorded only two instances of bovine infection in 680 cases of pulmonary tuberculosis, while Stanley Griffith found three instances in 212 cases. In 1928, however, Dr. Munro described ten cases of bovine type in 250 cases. The most striking features of this series were: (1) the amount of fibrotic change; (2) the lack of evidence of breaking down of the lung tissue; (3) absence of hæmorrhage. He thought the bovine type of case would be more likely to combat the systemic infection than the ordinary type. On the other hand Stanley Griffith regards the bovine tubercle bacillus as more virulent than the human type.

Skilled bacteriological examination of the type of bacillus in human sputum is obviously necessary. Dr. Munro's work may open a new chapter in the ætiology of human tuberculosis.

In the Malcolm Morris lectures, Sir Robert Philip points out that while much is being done for the treatment of cases of tuberculosis, very little attention has been paid to their prevention. He urges the use of the tuberculin test for the early diagnosis of tubercular foci and the radiographic examination of reacting persons.

Such examinations of school children and the supervision of those showing signs of unhealed foci both at school and afterwards when at work, would prevent the marked increase of tuberculosis which occurs at adolescence.

During the year there were 56,896 deaths from cancer, equal to a death-rate of 1,437 per 1,000,000 living persons. This rate is higher than last year. The recorded death-rate has doubled in the last thirty years.

It is remarkable how certain organs show a high proportion of cancer incidence. The œsophagus, stomach, liver, intestines, rectum and anus have a very high incidence, which in certain cases has changed very little during the past decade. There has been a distinct rise in the case of cancer of the stomach and intestines, lungs and pleura, pancreas and prostate, this may be attributed to the better means of diagnosis now available.

A chart is given showing the standardized mortality of males and females from cancer from 1851-55 to 1927. From this it would appear that in 1851-55 the susceptibility of females was double that of males, in 1921-25 the susceptibility was practically the same in the two sexes. Since then males have been more susceptible than females. The Registrar-General's reports show that the mortality from cancer in exposed sites of the body increases steadily from the highest to the lowest social class while for other sites it is approximately the same. From this it is argued that previous local disease or injury is of more importance than susceptibility or resistance.

In the section on the relation of food to health and disease, reference is made to Mrs. Mellanby's work on the rôle of vitamin D in the development

and preservation of the teeth, which we described fully in an editorial last year.

The importance of vitamin balance which has been insisted on by many workers is becoming generally realized. The amount of a particular vitamin in a food is influenced by other constituents of the diet. As an example of this interdependence, Harris and Moore have shown that an increase of the cod-liver oil concentrate (vitamins A and D) must be accompanied by a corresponding increase of the vitamin B complex if normal growth is to be maintained.

The vitamin D content of milk is increased by irradiation and it seems possible that in some cases its potency may be so increased as to have an effect on growing bones and lead to their premature ossification. The use of such milk must not be overdone.

The problem of a perfect diet for man has not yet been solved, but the broad fact emerges that in an adequate diet fresh natural foods, such as fruit and vegetables, and dairy products should be provided so as to ensure a supply of all the essential vitamins.

Deficiency diseases and rickets in their grosser manifestations are now comparatively rare in this country, but there is evidence to show that minor deficiencies may leave important effects of a less obvious character, possibly leading to impaired intelligence. The relation of deficiency in diet to mental backwardness would be an important subject for inquiry and is essential for the carrying out of an educational campaign on food in relation to health.

Experience on farms has shown that all utensils with which milk comes in contact should be heated for a few minutes by steam, at a temperature of 212° F. Otherwise it is impossible to fulfil the bacteriological requirements laid down in the Milk (Special Designations) Order. When the provision of steam-heating plant has not been insisted on by the licensing authority, there has been a failure to supply milk of good keeping quality with a subsequent discrediting of graded milks in general.

In 1929 there were 13,500 non-reacting cows included in the herds certified for the production of certified and Grade A (T.T.) milk, an increase of 1,500 over the preceding year. The department has decided that for the future the double intradermal test must be used for the discovery of tuberculous animals. Since July 1, 1930, the alternative test by the subcutaneous method has not been accepted.

It is interesting to note that in the production of graded milks licensees are making use of mechanical milkers and resorting to refrigeration at the farm so as to maintain a low bacterial count during transport and distribution.

Dr. Monier-Williams has worked out methods for the accurate determination of sucrose, lactose and invert sugar in sweetened condensed milk. The presence of invert sugar may be of importance as an indication of faulty preparation. Gross contamination with micro-organisms is usually

indicated by blowing of tins, but this may not be the case, and the only indication of their presence may be the partial inversion of sugar. Well-made condensed milk never contains any invert sugar and further information is desirable as to the reliability of the test as an indication of contamination.

Distributors of milk have complained that the presumption of adulteration with water when the milk contains less than 3 per cent of fat, or 8·5 per cent of solids non-fat, presses hardly on the small farmers who have difficulty in thoroughly mixing the milk of the several cows before sale. Evidence has been brought forward from experimental farms and other sources that even with a well-mixed milk the limit of 8·5 solids non-fat is too high.

In these circumstances it has been suggested that the freezing point is superior to all other tests for determining the presence of added water in milk. The test is, however, only applicable to fresh milk and is useless when the milk is sour. More use might be made of the test by public analysts when the milk is fresh, as it might prevent the vendor of naturally poor milk being brought into court to prove his innocence.

Wrappers made of hessian and stockinet are used for meat from Australia and South America to prevent fouling of the surface and the consequent loss due to the necessary trimming before sale. Six million wrappers are brought to this country every year and about seventy-five per cent of them are now being made into sacks. Formerly the wrappers were returned to South America, but the Argentine authorities now require all wrappers to be new. The Board of Agriculture and Fisheries drew attention to the possibility of such sacks containing food for animals being a source of foot-and-mouth disease. Experiments have shown that sacks stained with the blood of infected animals and kept under chilling conditions similar to those used in the exportation of meat from South America, are capable of infecting animals forty to fifty-five days after the slaughter of the infected animals, sufficient time for the hessian to be imported, made into sacks and delivered to a firm as containers for animal food. A double layer of stockinet which is not made into sacks was tried, but did not give sufficient protection to the meat.

Attention has been drawn to the practice of wrapping soft cheeses and other foods in tin foil. Soft cheeses wrapped in tin foil were examined in the Ministry's laboratory and found to contain from 0·7 to 4·3 grains of tin per pound. It is possible that after prolonged storage the amount of tin taken up may be considerably more than four grains per pound. It is suggested that grease-proof paper or similar resisting material should be used instead of tin foil.

The Ministry's "Intelligence Division" consists of two sections, administrative and medical, which in practice work in close collaboration and without definite limits separating the kind of work undertaken. The Medical Intelligence section became a differentiated part of the Ministry's organization in 1919, when it was found necessary to obtain prompt

information of the world incidence of epidemic disease which is likely to be imported into this country. Official arrangements for this purpose were made with the Foreign Office, the Colonial Office and the India Office. The Health Section of the League of Nations and the Office International d'Hygiène Publique and the Ministry's Intelligence Division now assist one another in collecting and disseminating information regarding the incidence and progress of outbreaks of infectious disease in the ports of the world, and they are aided in this work by the regional intelligence services of the League of Nations Bureau at Singapore, the Sanitary Bureau at Washington, and the Maritime and Quarantine Board of Egypt at Alexandria. A practical result of this organization has been that the Bills of Health carried by ships give little information that is not already in possession of the Port Health Authorities of most countries, and it is proposed to abolish the Bills of Health or to substitute for them a simple declaration of the occurrence of infectious disease on the ship itself instead of on shore at the different ports of call.

Dr. F. Griffith's work in the Ministry's Pathological Laboratory on the experimental modification of pneumococci has been confirmed by Neufeld and Levinthal in Berlin, and by Dr. Dawson at the Rockefeller Institute at New York. By subcutaneous inoculation of mice, Dr. Griffith was able to convert R into S forms of the homologous type of pneumococci by the introduction of large amounts of the living R organisms, and also by the injection of small amounts of living R organisms and large amounts of heat-killed homologous S cultures. He also obtained the conversion of R forms into S forms of different types by injecting small amounts of living R organisms with large amounts of heat-killed heterologous S cultures. Dr. Dawson thinks that the possibilities of alteration in type under natural and diseased conditions cannot be ignored and may be of great significance in infectious and epidemiological problems.

Dr. Griffith has also studied the streptococci found in subacute infective endocarditis. These apparently fall into two groups: (*a*) the viridans or *alpha* type which produces green pigment under and around the margin of the growth and beyond which there may be a zone of hæmolysis on blood agar; (*b*) the *S. indifferens* which has no action on the blood-cells in the medium. It is doubtful whether the distinction between the two groups is quite sharp, as it appears that the *S. indifferens* may on cultivation acquire the property of producing green pigment. The importance of these micro-organisms is beyond doubt, since besides being the cause of infective endocarditis there is considerable evidence of their association with rheumatic fever and rheumatic conditions.

By means of the Auxiliary Scientific Investigation Fund the Ministry has caused special investigations to be carried out on the epidemiology of influenza and on the therapeutic use of malaria in certain nervous diseases.

The first case of general paralysis treated by induced malaria was a male patient in the Whittingham Mental Hospital, Lancashire. He was

inoculated with the blood from a case of benign tertian malaria, in July, 1922. Since then the number of cases treated in the various mental hospitals in England has been 3,349, of which 2,862 were inoculated with malarial blood, and 487 were infected by the bites of mosquitoes made infective by feeding on selected cases of malaria. The Board of Control have now arrived at the conclusion that an attack of malaria prolongs the life of many patients suffering from general paralysis, and that the treatment has a remarkably successful effect in improving their mental and physical condition. As a result of experimental trials carried out at the Horton Mental Hospital, the original treatment has in some hospitals been modified by the use of a quartan instead of, or supplementary to, the benign tertian strain. A mild infection is allowed to persist instead of curing the case right out, as the curative effect of the treatment seems to depend not only on the pyrexia produced, but also on the continued presence of the parasites and toxins in the system of the patient.

In connection with imperial questions, Dame Janet Campbell was invited by the Australian Government to advise them on the establishment of a Maternity and Child Welfare Division in the Commonwealth Department of Health; Colonel S. P. James, at the request of the Secretary of State for the Colonies, visited Kenya and Uganda to advise the Governments on the measures to be taken to combat malaria; and Colonel L. W. Harrison attended the conference on the Health of the Mercantile Marine, at Geneva, and also the Thirteenth Session of the International Labour Organization.

Sir George Newman's Report shows clearly that a new type of preventive medicine is coming into being, and that the Medical Officer of Health, under the provisions of the Local Government Act, will have many new duties and greatly enhanced responsibility for the public health. The public health service and the treatment of sick persons are now conjoined under the same authority.

Under the Local Government Act the Medical Officers of Health of County Councils and County Borough Councils will be concerned in the carrying on of the Poor Law medical duties which have hitherto devolved on Boards of Guardians. The object of the Act is to unify the two main health services—that of the health service under the guardians for the poor and that of the health service under the county councils for the rest of the community—and the maintenance and development of the services thus unified. The Medical Officer of Health, as the adviser to the Council, will have to consider the necessary redistribution and rearrangement of the total hospital and institutional beds at the disposal of the authority. He will be concerned in the medical staffing of the authority's institutions and services. He will have to co-ordinate the medical provision for the sick and infirm, for maternity and infancy, for special diseases, infections, tuberculosis, and for venereal, orthopædic, ophthalmic, aural, skin and mental patients. There is also the vast out-patient population receiving medical

relief, to be dealt with. The appointment of local medical practitioners, or specialists, for out-door or institutional service, the question of paying-wards, the provision of facilities for medical education in institutions, are all issues concerning the medical officer of health. He will have to establish friendly co-operation with the private practitioners in his district, with the authorities of voluntary hospitals, and especially with medical schools and other university or hospital centres, when these exist.

Sir George Newman points out that the primary object of all the arrangements made by the health service of the Government is to build up a healthy race. Though the Ministry of Health can devise machinery and ensure that it is sensible and works well in practice, health can only be achieved by the people themselves. The nation must be educated in the art of healthy living, and the development and extension of the public health service has proved one of the most effective means of education in health. Not less educative have been the public medical services for health insurance, maternity, infant welfare, the care of the school child, and the control of infectious diseases.

One of the newest and most effective means of educating the people as to the importance of health is the newspaper press, both lay and professional. But above all there must be a will to health, as there must be a will to work. We must not lose ourselves in an orgy of public effort, which is apt to make the people forget the absolute necessity of doing something for themselves.

In Piam Memoriam.

ANDREW BALFOUR.

It is hard to realize that big, generous-hearted Andrew Balfour is dead, The Empire can ill afford this loss, for his death, at the age of 57, leaves a gap that no one else is competent to fill. The world of medicine is not wanting in great men to-day, but Andrew Balfour was more than a great man, he was an institution: There was something almost Johnsonian in his universality. One bleak winter day a London cabman was overheard to remark, "As Dr. Johnson said, there's nothing like a hot dinner." This pronouncement will not be found in the records of Dr. Johnson. Even in his own circle there were greater men than the Doctor, but for a London cabman to assume that a saying wise beyond measure in his estimation must have come from Dr. Johnson, is a tribute that no other man of that age would receive. And so in Andrew Balfour there was some indefinable element of greatness that ranked him in the general estimate far above other men higher in scientific achievement and more original in thought.

Balfour, with his stupendous energy and capacity for work, was a tower of strength to the Army in the Great War. He accompanied the Medical Advisory Committee to Mudros, Salonica, and Egypt, and later, as President of that body, he spent a strenuous year in Mesopotamia. East Africa, the Tanganyika Territory, Uganda, and, again Egypt, were all included in the range of his labours, and in the last-named country he carried out the trying task of reorganizing the public health service.

There is no need to enlarge here on Balfour's athletic triumphs, or on his early fame as a novelist in the Stevensonian succession, or to recount his many honours, for all these matters have already received ample notice elsewhere. But of the man himself something more may be said. His lovable disposition won him hosts of friends, and something in him inspired such affectionate respect that only one beyond hope of redemption, human and divine, would have let Andrew Balfour down. Transparently honest as one of his native mountain burns, he was constitutionally incapable of any mean act, and indeed, in his anxiety to give others their full due, he often fell short of justice to himself. He died a martyr to conscience. The cares of his own office were oppressive enough, but he thought it his duty to shoulder other responsibilities, and whatever he undertook he did it with all his might. Papers, speeches, and lectures followed in a bewildering succession, while at times his committees in themselves might have been

judged a full day's work. The completion of one task brought him no relief, for there were always other commitments in growing numbers to take its place. Conscientious and painstaking to a fault, he struggled on under the increasing handicaps of worry and sleeplessness, each intensifying the other, until the brave heart broke, and the end came.

Realizing all that he suffered in those last months, who now could wish to see him stretched out longer on the rack of this tough world?

* * *

"O maister, maister, God thy soulë reste."

Clinical and other Notes.

NOTES ON A CASE OF MENINGOCOCCUS SEPTICÆMIA.

By Major R. B. PRICE, D.S.O.,

and

Major E. O. A. SINGER,

Royal Army Medical Corps.

Majors F. G. A. Smyth and W. M. Cameron published an account of two cases of "prolonged intermittent pyrexia associated with an unusual organism in the blood-stream" in the Journal of the Royal Army Medical Corps, July, 1930, with a description of a third case clinically similar, but in which no organism had been isolated on blood-culture.

The present case has many similarities with those three cases; it is published, not because it is considered one of great rarity, but because it may be of interest especially to medical officers in the Service who frequently, and particularly abroad, have to deal with cases of prolonged pyrexia of uncertain origin.

In this connection, it may be recalled that Colonel J. C. Kennedy was the author of an article on meningococcus septicæmia in the Journal of the Royal Army Medical Corps of July, 1926, in which he reviewed four cases.

In its "Epitome of Current Medical Literature," extracts of articles on meningococcus septicæmia appeared in the following more recently published numbers of the *British Medical Journal*: May 5, 1928; July 4, 1928; June 2, 1930; and August 2 and 28, 1930. The description of the disease given in some of these papers closely tallies with our own case. In one of the extracts mention is made of the fact that the condition was first described by Soloman in 1902, and that its rarity is probably more apparent than real.

Drummer Lynch, aged 23, and with four years' service, was admitted to the Cambridge Hospital, Aldershot, on July 15, 1930. He had been suffering from a slight sore throat, pains in the back and legs, and slight headache since the previous day. His temperature on admission was 101·6° F., the pulse being slow in relation to the temperature. He was looked upon as a case of rheumatic fever and treated accordingly. No abnormal physical signs were discovered, but during the ensuing days he shivered repeatedly.

He first came under our observation on July 26, 1930, the thirteenth day of his illness. On the previous day his temperature, which was intermittent, had reached a maximum of 104° F. When first seen he had a labial herpes, a slightly injected throat, and a fairly profuse papular rash, with a few purpuric spots on the chest and arms, and particularly on the

legs. He complained of vague pains in the knees. A provisional diagnosis of septicæmia was made, the eruption suggesting that it might be meningococcal.

It is not proposed to give a detailed description of the case, day by day, from now onwards, but rather to describe the leading features.

The pyrexia lasted from the day prior to admission (July 14, 1930) to October 21, i.e., one hundred days, during which period there was only one day on which neither the morning nor evening temperature was raised. For the most part the temperature was remittent, but also at times intermittent, and waves of higher and lower pyrexia seemed to alternate. A temperature of 103° F. or over was recorded on eight different occasions, but at no time did it exceed 104° F. The pulse varied, but was comparatively slow throughout.

Attacks of shivering in the early stages of the disease have already been mentioned; later the patient had three rigors, but as two of these occurred in connection with the intravenous administration of anti-meningococcal serum they cannot be considered a part of the clinical picture.

As regards the eruption, this made its appearance in distinct crops, which occurred at intervals of from a few days to a week, and were a prominent feature throughout the pyrexial period. The eruption was pleomorphic and affected the chest, abdomen, back, and most profusely the arms and legs. It was not confined to any one aspect of the limbs. Papules of varying sizes, including erythema nodosum-like manifestations, which in some instances showed purpuric centres, independent petechiæ and one or two ecchymoses were observed.

Body pains also were complained of throughout the illness, chiefly in the regions of the joints, the knees, ankles and the left mandibular joint being particularly affected. The right ankle was actually swollen at one period, but none of the other joints showed any obvious enlargement. Other regions of the body affected with pains were the left side of the neck, the back, the precordium and the shins.

There were no signs of meningeal involvement at any time; and headache, when it occurred, was usually slight. Only on one occasion was severe headache complained of, but this occurred when the patient was constipated and yielded to appropriate treatment.

Apart from this one occasion the bowels acted well, and the tongue was clean throughout. Sore throat, except at the beginning, was not a feature of the case.

A few râles were heard now and then in the chest, but there was no cough. The heart was normal throughout, and no enlargement of the liver or spleen was observed, though frequent examination was carried out for signs of splenic enlargement.

Perhaps the most striking feature of the case was the very good general condition of the patient, who at no time gave one the impression of being seriously ill.

LABORATORY INVESTIGATIONS.

A history of malaria suggested repeated blood examinations, which, however, were negative as regards parasites on all occasions. The urine was normal, apart from the presence of a few leucocytes.

A moderate leucocytosis (13,000) was observed. The differential count was as follows: Polymorphs 70 per cent, lymphocytes 19 per cent, monocytes 4·5 per cent, eosinophiles 5 per cent, basophiles 1·5 per cent.

On July 26, 1930, a Gram-negative diplococcus was grown from the blood. The culture was contaminated with *B. subtilis*, but the organisms were separated by plating on trypagar and the diplococcus isolated. Its delicacy of growth, and the character of its colonies suggested a meningococcus. It fermented maltose and glucose, but not saccharose. It was not, however, agglutinated by the patient's own serum, nor by any of the four types of meningococcus serum then available in the laboratory. These sera were not of very recent date. Blood-culture was repeated on July 30, and on this occasion a similar Gram-negative diplococcus was isolated in pure culture. This was confirmed by a third blood-culture on August 3. A subculture of this organism was sent to the Royal Army Medical College, at Millbank, where Major R. F. Bridges reported that it fermented glucose and maltose only, and was agglutinated by meningococcal serum Type I to 1 in 125, and by Type II to 1 in 75. There was no agglutination with Types III and IV. This experiment was repeated with identical results in the laboratory at Aldershot with fresh samples of sera received from Millbank.

A vaccine was prepared from the organism, and administered as stated below.

Swabs were taken from the tonsils and the nasopharynx on July 28 (fifteenth day of illness). No meningococci were obtained on culture.

On September 27 (seventy-sixth day of illness) another nasopharyngeal swab was taken, and yielded on culture a Gram-negative diplococcus, resembling the meningococcus. This organism gave the carbohydrate reactions of the meningococcus, and was agglutinated by meningococcus specific serum Types III and IV up to 1 in 250, not by Types I and II. The agglutination was complete at 1 in 250 with Type IV, but did not extend to 1 in 500. The organism was not agglutinated by the patient's own serum.

A second vaccine was prepared from this meningococcus, and was injected as stated below. The temperature subsided within a few days of its administration on the ninety-fourth day of illness; but a blood-culture made on September 29 (seventy-sixth day of illness) was sterile, rather indicating that the intensity of the infection had by this time become diminished.

It is interesting to note that the organism recovered from the blood, and that isolated from the nasopharynx were of different serological type. The two vaccines may therefore have had some complementary antigenic value in combating the infection.

Treatment.

The treatment consisted of the following measures:—

(1) *Symptomatic.*—An iron and arsenic tonic to help in supporting the patient's strength. Aspirin to relieve the joint pains.

(2) *Speculative.*—Repeated courses of quinine were given in case a malarial infection should be present in addition to the septicæmia; they had no influence on the pyrexia.

Urotropin in doses of grains x, t.d.s. was given, with a few intermissions throughout the greater part of the illness, in the hope that it would form a barrier against the invasion of the cerebrospinal fluid by the organisms. Meningeal involvement did not occur, but it would be hard to say that this was the result of the urotropin medication. The vaccine treatment may also have had some immunizing effect.

(3) *Specific.*—(*a*) Polyvalent antimeningococcus serum: four intravenous injections of twenty-five cubic centimetres each were given between the twelfth and eighteenth day of the illness. These had no curative value, but were responsible for two rigors, one followed by collapse, and also for a serum rash.

(*b*) Vaccine treatment with a vaccine made from the organism isolated from the blood-stream. Nine injections were given between the thirty-second and eighty-seventh day, the dosage rising from five million to fifty million. In its earlier period of administration, this vaccine appeared to have some slight effect upon the pyrexia, but this effect was not subsequently maintained.

(*c*) Vaccine treatment with a vaccine made from the organism isolated from the nasopharynx. This was begun on the ninety-fourth day of pyrexia. The temperature settled six days later, and has remained normal since, and one is tempted to believe that these two events may be not entirely unconnected. This vaccine is still being continued.

There was no indication for the performance of a lumbar puncture during the course of the illness.

It may be mentioned that little more than a year ago we had a previous case of meningococcal septicæmia in this hospital which, after a febrile illness lasting over two weeks, and accompanied by a purpuric eruption, developed meningitis but ultimately made a complete recovery. In this case the meningeal symptoms, intense headache, stiffness of the neck, etc., set in with dramatic suddenness. As the patient was already in hospital and known to be suffering from meningococcal septicæmia it was possible to administer serum intrathecally at the earliest moment.

In conclusion, we would like to thank Lieutenant-Colonel O. Ievers, D.S.O., Commanding Cambridge Hospital, Aldershot, for permission to publish these notes; and Major F. Holmes, R.A.M.C., for carrying on with the clinical side of the case during the absence of one of us.

AN ABRASION, SOME TANNIC ACID AND A CEREBRAL REFLEX.

By Major W. BLIGH, O.B.E.
Royal Army Medical Corps.

In these days of motor accidents, large abrasions of the skin have become very common, and though of small surgical significance are, until healed, an ever present source of discomfort to the patient. For beneath their area they lay bare the nerve terminals of sensation, and at every movement every terminal phones up to the conscious mind a cry for mercy or a wail for help. And the help they demand, in no uncertain terms, is to be once more safely embedded in healthy epidermis or something else that, for the time being, can take its place.

To supply this want, our treatment in the past has been directed and not always very happily. Ointments, spread thinly on lint, though they cover and soothe, by their physical nature prevent the abrasion drying and encourage the formation of granulation tissue. Antiseptic and astringent powders, though useful on small abrasions on exposed surfaces, have a very limited use on large abrasions of surfaces usually covered by clothes. Dry dressings stick, and their removal in the gentlest manner reduces the injured surface to much the same state as it originally had; and wet dressings, covered with jaconette, are too slow in healing power for the very reason that they are moist. The best treatment was perhaps exposure to sunshine, but alas! our island skies give us this powerful remedy for all wounds in so grudging an amount.

It was therefore, with mingled feelings of pity and helplessness that one morning lately I saw in the Surgical Ward a face and thigh of an N.C.O. For the face, in between and under various small abrasions, registered abject self-pity and misery, and the thigh, from hip to knee, was one huge abrasion. He had been dressed the evening before with a dry dressing, after taking a somersault off a skidding motor cycle and had passed a most unhappy night.

It was entirely due to the action of a parental Government in sending out a booklet on the treatment of burns by spraying with tannic acid solution that "down in the forest (of one's grey matter) something stirred." That what was sauce for the goose should also be sauce for the gander was no great leap for even a cloudy nerve-cell to take, and immediately the reflex idea rolled on to the floor of consciousness.

Accordingly, the thigh, naked under a cradle, was sprayed hourly with 2·5 per cent solution of tannic acid in sterile water. The result was dramatic. In a few hours, the unhappy N.C.O. became a happy one, for lapped in a rapidly forming tannate scab, the outraged nerve endings had sunk joyfully to sleep. In forty-eight hours the scab was tough enough to permit gentle movement about the ward.

In a few more days a valuable N.C.O. returned to duty.

Echoes of the Past.

THE ARMY MEDICAL SERVICE IN INDIA, 1840-53.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

The responsibility for maintenance of law and order which followed our assumption of the position of paramount power in the Indian Peninsula imposed constant hard work on the British soldier for the first forty years of the nineteenth century. When the menace of Napoleon was removed the military establishment which Parliament could be persuaded to maintain was so small that, when Indian and colonial garrisons had been provided for, less than a quarter of the Army remained at home. Owing to there being so few reliefs available, regiments at this time might remain overseas for twenty or thirty years.

The Gurkha war of 1814-16 had been followed by the Pindari war and the third Mahratta war of 1817-18, which completed the pacification of Central India. In 1818 Ceylon was subjugated mainly by the exertions of three British regiments involving a very great mortality from sickness. In the Burmese war of 1824-26, ending in our protectorate of Assam and the annexation of most of the sea frontage of Burma, six soldiers out of every seven died. An outline of the events following the ill-considered invasion of Afghanistan in the year 1839 has already been given; at the same time an expeditionary force from India was operating in China. In 1843 Sir Charles Napier completed the conquest of Sind, and Sir Hugh Gough engaged a Mahratta army in the native State of Gwalior. Two years later we were involved in hostilities with the Sikhs, which terminated in 1849 with the annexation of the Punjab. In 1852 there was a second Burmese war.

Allowing for the fact that the pre-Mutiny regiments of the Hon. East India Company's native troops have few historians, and that for details of the fighting in all these wars the student must rely largely on works written from the point of view of the Queen's or the Company's European regiments, it is impossible to resist the conclusion that almost all the serious fighting in these latter campaigns was done by the Europeans. About this period there is evidence of a dawning appreciation on the part of the nation that the British soldier, so far regarded as "an outcast from society and an object for vituperation of pamphleteers, of agitators, and windbags in Parliament,"[1] might perhaps be deserving of a little more consideration

[1] Fortescue.

than he was accustomed to receive. No doubt various factors contributed to this change of attitude. The publication of the health statistics of various foreign garrisons, commenced under Sir James McGrigor's auspices in 1835, did much to reveal to the public eye the conditions the Army had to face in its task of policing and consolidating the Empire. The authors of the first report, Deputy Inspector Henry Marshall of the British Medical Service, and Lieutenant Alexander Tulloch of the 46th, were, moreover, no mere statisticians, but men who devoted the best part of their lives to the promotion of the soldier's welfare and securing an amelioration of his condition.

In 1837 the punishment of flogging was greatly mitigated, good conduct pay was instituted, and diet and quarters in the tropics began to receive attention. After 1847 a limited term of engagement was introduced in place of the life sentence formerly accepted by recruits.

Medical Officers of the British Service made their first appearance in India in the year 1754, when the 39th (1st Dorsets), who still bear the motto "Primus in Indis," were lent to the East India Company. From that date they had served continuously side by side with their brothers of the Company's service, but except for the three Inspectors of Hospitals of the King's troops appointed to each of the three Presidencies in 1825, always in a regimental capacity. The duties of the said Inspectors were confined to what was called officially the superintendence of the professional practice of the hospitals, "leaving economical concerns to the Superintending Surgeons of the Company." Each of the Presidencies had its own medical department, controlled by a Medical Board, the members of which were not apparently selected for their administrative abilities, and as a rule showed little competence or originality in handling military affairs. Each army was administered by its own Commander-in-Chief, though the Commander-in-Chief in Bengal exercised a certain authority over the whole.

The China War, 1840-42.

The China expeditionary force was despatched from India early in the year 1840, at the request of the Imperial Government, owing to the arrogant behaviour of the Chinese towards traders carrying on commerce under the British flag. In the beginning of May a naval squadron assembled at Singapore with twenty-six transports carrying the 18th Royal Irish from Ceylon, the 26th (1st Cameronians) from Calcutta, the 49th (1st Royal Berks), two companies of Artillery, two companies of Sappers and Miners, and a composite Indian infantry battalion. On arrival in Chinese waters operations commenced with a blockade of the coast, a matter which concerned the Navy. Meanwhile the soldiers were landed at Ting-hai on the island of Chusan, which had been occupied with little difficulty in July. Here they were allowed to remain for the next six months. "The men were placed in tents pitched on low paddy fields surrounded by stagnant water, putrid and stinking from quantities of dead animal and vegetable matter.

Under a sun hotter than ever experienced in India, the men on duty were buckled up to the neck in full dress coatees, and, in consequence of there being no camp followers, fatigue parties of Europeans were daily detailed to carry provisions and stores from the ships to the tents and to perform all menial employments."[1] The rations were salt beef and biscuits; a proportion of the beef had been salted in India and was uneatable; the biscuits were mouldy. The water was drawn from irrigation channels. The men's clothing was entirely unsuited to the climate. With the full dress coatee with tails, tight nankeen trousers were worn, and a very heavy shako. For undress, they had a tight shell jacket and a forage cap. During this period, in a strength of 2,500, there were 5,329 admissions to hospital and 448 deaths. To malaria were ascribed 2,654 admissions and 91 deaths, diarrhœa accounted for 829 admissions and 70 deaths, and dysentery for 759 admissions and 218 deaths. There were 255 cases diagnosed as continuous fever. According to Surgeon General Maclean, who served in the island as an assistant surgeon with the Artillery, much of the sufferings of the troops was due to the ignorance and obstinacy of the colonel who succeeded to the command on the death of Brigadier Oglander. Various representations were made by Dr. King, the Company's superintending surgeon, but they were received in such a contemptuous and insulting manner that the doctor lost heart and went back sick to India. For political reasons, the buildings in the town were not occupied. The Royal Irish, who were quartered in a joss-house on high ground, escaped with a death-roll of 52, as compared with 142 in the 49th and 268 in the 26th.

It is doubtful, however, whether the town with its narrow streets and stagnant canals was much preferable to the paddy fields. The Cameronians did move in during September, when their 400 sick were accommodated in a large, though ill-adapted, building, but the plague was not stayed. Considering the season and the local conditions, the only real remedy consisted in the embarkation of the troops. There was no serious military objection to this course, but owing to some muddle, the transports, which were outside Army control, had been filled up with naval stores and could not be made available.

In the spring Chusan was temporally evacuated and the remains of the garrison were transferred to Hong Kong, which was secured as a new base. On March 2, 1841, Sir Hugh Gough arrived from India and took over command of the troops. Combined naval and military operations followed, which put us in possession of the city of Canton. Terms were exacted and the place was not occupied, the force returning to Hong Kong heavily infected with dysentery and intermittent fever. In the course of the next twelve months a number of seaport towns were occupied and garrisoned.

[1] D. Macpherson. "Two Years in China."

Battle casualties were negligible, and the sick wastage enormous. In June, 1842, reinforcements were received, including the 98th regiment and five battalions of Madras infantry. In August, as a result of a combined demonstration in the Yangtsze River and a threat on Nanking, the Pekin Government came to terms. Throughout these latter operations the sun proved a more formidable adversary than the enemy. In the assault on Chinkiang Fu, the most severe engagement of the war, there was a total casualty list of 144, an appreciable proportion being due to heat stroke. Of the 98th, thirteen men died outright. The Royal Irish were fortunate in not having a case, owing to the courageous but unprecedented action of their C.O., who, on the urgent representation of his adjutant, allowed the men to discard their greatcoats, to remove their stocks and sling them over the left shoulder, and to undo three jacket and three collar buttons!

A treaty followed by which five ports were opened to trade, and the island of Hong Kong became a British possession. A garrison remained in Chusan for the next four years, whose history is written on the gravestones in the walled cemetery on Joss House Hill. In the years to come Hong Kong was to acquire a no less unenviable reputation as the grave of the British soldier.[1]

This expedition left India without any definite idea on the part of those who despatched it as to what it would have to do, or the seasonable and climatic conditions it might have to face. At the outset, when vigorous action might have finished the war in a matter of months, if not weeks, both the Navy and Army suffered from the weakness, vacillation, and credulity of the political agent who directed their movements. The tragedy of Ting-hai was the same fatal muddle which was repeated on a larger scale in the Crimea fourteen years later, the result of defective organization of the administrative services, and lack of co-ordination of the work of the naval, military and civil departments. The arrangements made for the medical requirements of the Army are said to have been deficient. Wherever the fault may have been, the Company's superintending surgeon and the officer commanding the troops in Chusan failed to collaborate. Sir Hugh Gough on his arrival appointed a Queen's officer, Surgeon James French of the 49th, to be P.M.O., and the latter rapidly acquired his confidence and that of the whole force. He was allowed a very free hand, which he exercised with much success.

The mortality of this war was due almost entirely to sickness. The Cameronians left India 900 strong. They received 900 recruits from Scotland during the campaign, and marched into Edinburgh Castle in 1843 the same strength as they left India. The casualties of the Royal Irish were 9 officers and 348 other ranks. The 98th under Colin Campbell,

---

[1] *Vide* article by Major W. K. Morrison, Journal of the Royal Army Medical Corps, May, 1930.

whose only permanent resting place for twelve months had been an overcrowded transport, arrived at Hong Kong in December, 1842, having lost 283 men, with a half company mortally sick, and with 80 fit only for permanent invaliding. It may be noted that the year 1840 marked the commencement of one of the great cholera pandemics. The reinforcements coming from India have been credited with the introduction of the disease to China, whence it spread to Burma, reaching Europe in 1848.

The following medical officers of the British Service were engaged in the China War:—

18th Royal Irish, Surgeon D. M. McKinley, Assistant Surgeons C. Cowan, J. Baker (died), J. Stewart; 26th (1st Cameronians), Surgeon W. Bell, Assistant Surgeons Chilley Pine, W. Godfrey Bace (died), J. R. Brush; 49th (1st Royal Berks), Surgeon James French, Assistant Surgeons Campbell Flyter (died), R. H. Garrett; 55th (2nd Border), Surgeon Archibald Shanks; 98th (2nd N. Staffs), Surgeon E. H. Blake, Assistant Surgeon E. Damaresque Batt; Ordnance Medical Department, Assistant Surgeon J. E. Parratt.

Sir Charles James Napier in Sind, 1842-47.

Sind, in the year 1842, was in the hands of a despotic body of Baluchi nobles, the Amirs, who had risen to power about seventy years before. They had consented very unwillingly to a treaty permitting the passage of British troops through their country to Afghanistan in 1839, and subsequently to the occupation of Karachi and Tatta and the free navigation of the Indus. When Sir Charles Napier, on his arrival to take over command in July, 1842, found sufficient evidence of hostile designs on their part to advise the annexation of a large part of the country, they began to make open preparation for war.

In December British headquarters were fixed at Rohri and the Army commenced the passage of the Indus. The European contingent of the force consisted of the 22nd (Cheshire) regiment, which had been brought up from Karachi, the remainder, with the exception of a few British artillery-men, were Indian troops.

Operations commenced with a remarkable expedition undertaken for the reduction of Imamgarh, an impregnable refuge of the Amirs of Khairpur in the heart of the desert eighty miles away. There was no certainty about the route or the watering places and transport was scarce. Napier decided therefore to carry out a raid with a small force. For this purpose he selected 350 men of the 22nd, whom he mounted on camels in pairs, 200 of the Sind (Jacob's) Horse, and two guns of the Camel Battery. The distance was covered in seven marches, "the first three through thick jungle, not a very bad road, the remaining four through an ocean of loose sand hills, sometimes very high and steep, over which there was much difficulty in taking the guns. Fatigue parties of infantry were constantly required to drag these up the ascent, although sometimes twenty-five camels were

yoked to each besides." The fort, which was found deserted, was blown up and the column returned without a man on the sick list.

On January 27, negotiations having proved a failure, the Commander-in-Chief commenced to move south with 2,800 men.[1] Transport, including that of the guns, was by camels, and the sick were carried in kajawahs. The Baluchi army was found on February 17 drawn up near the village of Miani, ten miles north of Hyderabad, its strength being estimated at 22,000. Baggage and hospital were parked inside a ring of camels, made to lie down with their heads inwards, and with piles of bales in the intervals, while the troops advanced on the enemy. The 22nd, when ordered to charge, found themselves suddenly confronted by the main body of the Baluchi army concealed in the dry bed of the Fuleli River, which they proceeded to engage with volleys at a range of ten yards. "Napier himself rode slowly up and down between the opposing arrays, pouring out torrents of blasphemous exhortation. His appearance was so strange that the Baluchis might well have mistaken him for a demon. Beneath a huge helmet of his own contrivance there issued a fringe of long hair at the back, and in front a large pair of round spectacles, an immense hooked nose and a mane of moustache and whisker reaching to the waist."[2] After a critical fight of four hours, the position was turned, and the Baluchis, having received the most severe punishment, sullenly drew off. Our casualties were sixty-four killed and 194 wounded, of which the 22nd contributed nearly a third. The senior medical officer in this engagement was Dr. John Dalrymple, of the Company's service, to whose "activity and zeal" Napier referred in his despatch. The surgeons of the 22nd were Alexander Campbell and John Anderson.

After the battle, Hyderabad was surrendered and seven of the Amirs gave in their submission. One, Sher Mahomed, of Mirpur, still remained in the field, and Napier, having formed an entrenched camp on the river in which the sick and wounded were placed, sent for reinforcements. When these arrived on March 23 the weather was already hot. The following day a battle took place at Dabo, within two miles of the city, when another victory was won at a cost of 270 casualties. "The exertions of the officers of the medical service under Inspecting Surgeon [D. C.] Bell" were described as "very laudable."

The next three months were occupied in hunting down the enemy with small columns in the terrific heat of the Sind desert. The marches were mainly made at night, the men remaining in their tents by day with wet towels round their heads. Even so, there were many casualties from the sun. On the day the operations ended the General himself succumbed, also thirty-three other Europeans, who were all dead within three hours.

---

[1] H.M. 22nd Regiment, Sind Horse, Poona Horse, 9th B.C., three battalions Bombay infantry, Madras Sappers and Miners, twelve guns.

[2] Fortescue.

For four years Sir Charles Napier governed the Province, garrisons were established, and a permanent settlement effected. Karachi, the seat of government, became an important seaport town. Sir Charles was not only a great soldier and a born leader, but also a great organizer. Though essentially a man of action, all his undertakings were carefully thought out, so far as time allowed, with an attention to detail worthy of the Duke of Wellington. Economy of transport and, until battle was joined, conservation of man power, were always in his mind. In the field, baggage was rigorously cut down and transport animals properly cared for. His care of his men, by whom he was idolized, was proverbial. Thanks to efficient organization and reasonable forethought, sick wastage during active operations was kept within bounds. In cantonments, much of the improvement in the soldier's welfare now manifested was due to his initiative. That he was not more successful in controlling some terrible outbreaks of disease which occurred during his administration of Sind was due to no want of effort on his own part.

The year 1843 was a malarious one, sickness was universal, crops were abandoned and the Army was prostrate. Sir Charles wrote to the Commander-in-Chief in Bengal,[1] "I can tell you as much about the sickness as the doctors. Malaria has long been watched by me in various countries . . . the cause is known to be decayed vegetable matter. Nothing in the power of government can prevent it; while the Indus overflows its banks and rain falls, malaria will be present in Scinde. But it may be diminished by cultivation which will substitute crops for decayed vegetable matter. When this cannot be done without inconvenience to the inhabitants, by turning ponds into tanks with sides of masonry; by building good barracks, especially for the Europeans. The stench of a low barrack in the morning is horrible. No European barrack should be less than thirty feet high, the number of men should be painted on the doors, and officers held responsible that it is observed. The heat of the country is tremendous, and if the men have not thick walls and lofty rooms sickness is inevitable.[2] Such barracks are expensive no doubt; so are sick soldiers; so are dead soldiers. But the difference of these expenses is that the first is over and done with, the second goes on increasing like compound interest and quickly outstrips the capital." Barracks on these lines were built at Karachi and Hyderabad. At the former Napier caused a public vegetable garden to be planted to combat scurvy; at Shikarpur and Sukkur he ordered engineering work to be undertaken to control the inundations of the Indus which were

---

[1] Sir William Napier's "Life of Sir C. J. Napier."

[2] An Army Order issued by Sir Charles Napier when Commander-in-Chief in India [1850], after prohibiting the accommodation of married soldiers in barrack verandahs and providing for them in separate common barrack rooms, stated, "It is not the amount of square but cubic feet, that should form the basis of all calculations. This allowance should be at the least 1,000 feet of air for every man, woman and child."

recognized as a cause of fever. He held strong views on the injurious results of excessive drinking, and not unreasonably considered that the allowance of five ounces of raw spirit per head per day in the canteen was excessive. In this most of the regimental doctors heartily concurred, but it is easy to spoil a good case by overstatement.

The 78th (Seaforth) Highlanders were ordered to march from Karachi to Sukkur late in August, 1844, where they arrived in October in apparently good health. Almost immediately they began to succumb to a devastating epidemic of what it seems reasonable to suppose was pernicious malaria. In seven months they lost 3 officers, 532 other ranks, 68 women and 134 children. "Some lingered for weeks, some for days. It was not infrequent to hear of the death of a man to whom one had spoken but half an hour previously. The hospital was filled with upwards of 800 men under treatment. Some hundreds of the less dangerously affected were marched about a few paces in the hope that by being called 'convalescent' the mind might act beneficially on the body, but as death called them away the group became less and less. Quinine alone appeared to give them any relief and their eagerness for it was pitiable to behold." [2]

There is no evidence that the rumour prevalent in Karachi of the excessive drunkenness of this distinguished regiment had its origin in any remark dropped by the Commander-in-Chief, but in a private letter, published in his life, he wrote, "About the 78th sickness, all you may see in the *Bombay Times* is miserable stuff. The real cause is drink." Whatever share rum may have had in the matter—and the commanding officer indignantly offered to produce his canteen accounts—such a statement was, to put it mildly, an exaggeration. The barracks at Sukkur were vacated the following year.

Sir Charles Napier's last year at Karachi was marked by a bad outbreak of cholera, in which his favourite nephew, John Napier, and his great-niece perished. In the course of a week the 86th regiment (2nd Royal Ulster Rifles) lost 208 men, apart from women and children. Between January 11 and July 20, 1846, in a community of 8,566, there were 1,838 admissions to hospital and 918 deaths. At the commencement some of the troops were moved out to the Ghizri ridge, but little improvement resulted. Sir Charles was indefatigable in visiting the hospitals. He had a firm belief in the free administration of water, which he urged the surgeons to adopt. On June 18 he issued an order that 3 officers, 9 sergeants and 100 men were to be camped near each regimental hospital and be divided into three reliefs, each of which was to do six hours' duty in nursing the sick. The officer was directed to assume all the surgeon's duties except that of treatment, and he, or one of the sergeants, was to personally supervise the administration of all alcohol ordered by the medical officers.

A detailed report of the epidemic from the pen of Surgeon Alexander

[2] Davidson. "History of the 78th Regiment."

Thom was published as a Blue Book. "The disease," he stated, "was resultant on a diathesis engendered by the united action of high temperature, a large proportion of vapour suspended in the atmosphere, and impeded ventilation on the surface of the earth." He thus described the scene in his hospital on June 16 : "As the night closed in a scene presented itself such as few minds can conceive or pens depict. The floors were literally strewed with the livid bodies of men labouring under the pangs of premature dissolution, surrounded by crowds of attendants trying to alleviate their hopeless sufferings. Many were brought in with the cold and clammy damp of death, as if sudden obstruction of every vital function had taken place and the fountain of life had been arrested by an invisible but instantaneous shock. For these all human aid was in vain. Others were struggling with all the violence of strong men against the agony produced by the spasmodic action of the muscles of the body, and their yells and cries, commingling in fearful discordance with the subdued groans and gaspings of those nearer the closing scene, were truly heart-rending. After June 16 the number of daily admissions began to decrease, but the places of those who continued to fall victims to the disease were too often occupied by men who had lately been their attendants. Indeed, it not infrequently happened that the soldier attendant was found lying in the agonies of the disease beside the pallet of his dying charge." It may be easy enough, in the light of modern knowledge, to criticize many of Sir Charles Napier's sanitary orders in detail, especially in the handling of a cholera epidemic, but his persistent and successful exertions for the welfare of the army in India deserve to be held in perpetual memory.

(*To be continued.*)

Current Literature.

E. GRIFFITHS-JONES, H. ATKINSON and ALI HASSAN (Research Section, Public Health Laboratories, Cairo). **A Comparison of the Relative Killing Power of Chlorine and Chloramine on Schistosome Cercariæ of the Human Type, together with a Note of the Relative Stabilities of Chlorine and Chloramine.** *Annals of Tropical Medicine and Parasitology.* University of Liverpool. Vol. xxiv, No. 4.

The authors carried out a series of experiments on the effect of chlorine and chloramine on the cercariæ of both varieties of the human Schistosome parasites. Infected planorbis and bullinus snails were thoroughly washed so as to remove any cercariæ which might be adhering to the shells and then placed in fresh water, incubated at 37° C. for twenty minutes and left at room temperature for another twenty minutes. It was hoped that by

this procedure all the discharged cercariæ would be quite fresh. The amount of available chlorine in the bleaching powder and chloramine was carefully standardized and adjusted immediately before adding the cercariæ.

Preliminary tests were made on the stability of chlorine solution prepared from bleaching powder, and chloramine solution made in the apparatus supplied by the United Water Softeners, Limited, and according to their instructions. The chloramine decomposed more rapidly than the chlorine from bleaching powder; between thirty to forty per cent of the available chlorine in the chloramine was immediately dissipated.

The authors then state that "reference to the papers of Harold (1925-26), published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, showed that poor concentrations of chloramine were obtained when the concentrations of chlorine and ammonia were high, and it was concluded that twenty-five parts per million of chlorine was the optimum concentration for practical purposes."

They then made a solution of chloramine according to the following method: "To a jar containing about 20 litres of tap water 0·78 gramme of ammonium chloride (equivalent to 10 parts per million NH_3 in 25 litres of water) was dissolved, and 250 cubic centimetres of chlorine water, prepared in the apparatus and adjusted to 2,000 parts per million, was added by pouring down a rapid stream of tap water into the jar and shutting off the tap when the level reached the 25 litres mark. Thorough mixing was ensured by further stirring."

"This solution contained twenty parts per million chloramine calculated in terms of the chlorine originally added."

In July, 1929, experiments were made with dilutions of chlorine and cercariæ of the mansoni type in *tap* water. The source of the chlorine was bleaching powder. In 1 part per million of chlorine the cercariæ died in two and a half to two and two-thirds hours, in 2 parts per million they died in thirty to thirty-five minutes.

With chloramine, one part per million (prepared by the first method) and cercariæ in *tap* water, the cercariæ were not dead after three to three and a half hours; they died in two parts per million in two and a half hours.

When chlorine solution made from bleaching powder and cercariæ were added to *raw Nile water* the cercariæ were alive after three and a half hours in dilutions of 1 to 2 parts per million, but died in one hour in 3 parts per million. Chloramine, in dilutions of 1 to 3 parts per million, added to *raw Nile water* gave the same results as the solution of chlorine.

In October and November, 1929, using both mansoni and hæmatobium cercariæ, experiments were carried out with chloramine prepared according to the water cart method. In a dilution of 1 in a million in *tap* water, the chloramine so prepared killed the cercariæ in thirty minutes to one hour, and in a dilution of 2 parts per million the cercariæ died in fifteen minutes.

When the dilutions were made in *raw Nile water* the cercariæ were not dead after three and a half hours in one part per million in one series

of experiments, in two others they were dead at the end of one and a half to two hours.

The results of the experiments made with dilutions of bleaching powder in tap water were practically the same as in the experiments carried out in July. In a dilution of one part per million the cercariæ died in about two and a half hours. When the dilutions of bleaching powder were made in *raw Nile water* the hæmatobium cercariæ lived for three and a half hours in dilutions of 1 part per million and 2 parts per million, but died in one hour in 3 parts per million. The mansoni cercariæ were killed in one hour by 2 parts per million of chlorine in *raw Nile water*.

The authors arrived at the following conclusions:—

(1) Both *S. mansoni* and *S. hæmatobium* are susceptible to the action of chlorine and chloramine.

(2) One part per million available chlorine will kill the cercariæ in two and a half to three hours in filtered water.

(3) Chloramine when prepared in the apparatus supplied by Messrs. United Water Softeners, Ltd., and in accordance with the printed instructions which they supply, is less effective than chlorine in killing the cercariæ.

(4) Chloramine, when prepared according to the water cart method, is more effective in killing cercariæ than bleaching powder. One part per million will kill the cercariæ in one hour in filtered water.

(5) Chloramine prepared by the admixture of the ammonia compound [ammonium chloride] and the chlorine solution in syphon [Water Softener's method] was found to be far less stable than chlorine prepared from bleaching powder or from chlorine bulb, whereas prepared by the method used in the later experiments [October and November, 1929], the reverse is the case. The stability of chloramine was demonstrated particularly in its resistance to absorption by matter in suspension and solution. Absorption by tap water is only slight but is higher in both *raw Nile water* and canal water.

The absorption increases with the dose and also with the time of contact. The amount remaining after two hours' contact is roughly three-quarters of the dose in *raw Nile water* and rather less in canal water. The amount of residual chlorine when bleaching powder is used is distinctly less, viz., about half the dose in *raw Nile water* and still less in canal water after two hours' contact.

(6) Inquiries from different water-works around Cairo show that the average time between the discharge of the water from the filters till it is received by the consumer in Cairo is one hour, in Maladi one or two hours, and in Giza two and a half hours. Therefore, chloramine can be used in the concentration of one part per million with practical safety for bilharziasis. If chlorine from bleaching powder is used in the concentration of one part per million, some method of storing the water for about four hours has to be used before it is delivered to the consumer. This end may also be

achieved by employing about three parts per million of chlorine from bleaching powder with subsequent dechlorination after one hour.

[The fact that chloramine is very slowly absorbed by organic matter was pointed out by Major Harold in 1925-26.

It is curious to note that in the second series of experiments carried out by Griffiths-Jones and his co-workers the amount of chloramine absorbed in one hour from a dilution of one part per million in filtered water varied from 0 to 0·2 and 0·3 part per million, while the amount of chlorine absorbed in the same time from a bleaching powder solution in tap water containing one part per million of chlorine varied from 0·3 to 0·55 part per million. The chloramine solution killed the cercariæ, but the bleaching powder solution was ineffective. It seems possible, therefore, that the action of the chloramine may not be entirely due to the contained chlorine and that some specific action may be at work.

It would be very interesting to know how the cercariæ behave in the clarified water in the water cart treated with bleaching powder in the ordinary manner after the usual tests. We know that unless the chloride of lime contains 33 per cent. of available chlorine, each spoonful of chloride of lime added to the water cart does not represent one part per million of chlorine. It is likely, especially in the conditions obtaining in Egypt, that prolonged contact with the chlorinated water would be required to kill the cercariæ.]

ASHFORD, Lt.-Col. M. **Evaluation of the Efficacy of Calomel Ointment for Venereal Prophylaxis.** *Military Surgeon.* 1931, 68, 1, 57.

This study is based on the records of venereal incidence in the Hawaiian Department for the six-months period, January to June, 1930. The mean strength of this command was 15,565. Excluding cases arising outside of the Department, the new case rate per 1,000 per annum was, for the entire period, 13·49. The ratio of venereal infection to exposure, as indicated by the number of prophylactic treatments, establishes the fact that less than 0·5 per cent of the men who took the prescribed prophylaxis developed venereal disease. This prescribed prophylaxis includes the use of a silver solution in addition to calomel ointment.

During the period of this study, 9,726 men received prophylactic treatment at the Honolulu City stations and 99·81 per cent escaped infection. Of these men, 1,824 also used calomel ointment before or shortly following exposure, and among them 99·67 per cent. escaped infection. The inference is that those who used an early application of calomel ointment did not hasten to undergo the full treatment and hence were somewhat less successful. It is specially noted that the infections which did occur in this group of 1,824 men were all gonorrhœa.

The writer concludes that calomel ointment is of great value in preventing syphilis, but of little use as a prophylactic against gonorrhœa, and he emphasizes the importance of employing a silver salt in addition.

No cases of chancroid occurred, although many thousands of immigrants, seamen and others pass through the port annually. The writer attributes this apparent immunity to chancroid to the natural habits of the military and civil population in the matter of personal physical cleanliness.

Reviews.

A SYNOPSIS OF MEDICINE. By Henry Letheby Tidy, M.A., M.D., B.Ch.Oxon., F.R.C.P. Bristol: John Wright and Sons, Ltd. 1930. Pp. xv + 1032. Price 21s. net.

The fact that this book has now reached its fifth edition is proof of the need felt and of its popularity.

It forms a companion volume to Hey Groves's synopsis of surgery, and is written for the same class of reader.

With succeeding editions this type of book tends to become more of a textbook than a synopsis, but in spite of much in the way of new material Dr. Tidy has only added 30 pages to this edition.

As a book of reference to the busy practitioner or the medical officer away from the assistance of a good library the book has a special appeal. It is complete, well arranged, and an excellent index makes a search for information very simple.

It can be confidently recommended to the medical officer in the Services who has limited facilities for carrying a large library about the world with him. J. H. M. F.

CLINICAL CHEMISTRY IN PRACTICAL MEDICINE. By C. P. Stewart and D. M. Dunlop. Edinburgh: E. and S. Livingstone. 1930. Pp. ix + 246. Price 7s. 6d.

As is indicated by the title of the book, the authors deal with the application to the patient of the findings of chemical investigation. Concise descriptions are given of the essential physiological principles involved in the functions of the organs dealt with. Although the book is not intended to be a laboratory handbook, the tests recommended by the authors are fully described.

There is an excellent chapter on the methods of collection and preservation of samples which are to be submitted for chemical examination, a most important matter, neglect of which leads to much trouble and delay and, it may be, to inaccurate results. The discussion of chemical

findings and their relation to clinical conditions will be found of great value by clinicians and laboratory workers.

At the end of each chapter there is a short bibliography and a very full index adds to the value of a most useful book.

THE STUDENTS' HANDBOOK OF SURGICAL OPERATIONS. By Sir Frederick Treves. Fifth edition revised by Cecil P. G. Wakeley. London: Cassell and Co., Ltd. 1930. Pp. xi + 535. 190 illustrations. Price 10s. 6d.

The fifth edition of this well-known book has been revised and brought up to date by Mr. Wakeley. Much new material has been added, but the volume has been kept to its original compass by omitting operations which are only of historical interest. The number of illustrations has been largely increased, and many of the former illustrations replaced by more satisfactory ones.

The treatment of varicose veins and hæmorrhoids by injection is now included, and there is a new chapter on the treatment of carcinoma by radium.

This has always been one of the few books in which all the set operations, such as ligature of arteries, excisions of joints, amputations, &c., could be found in a reasonably small compass, and the knowledge required for examinations in operative surgery obtained.

The book can be thoroughly recommended to all students and those entering for the higher surgical examination.

J. M. W.

EMERGENCY SURGERY. By Hamilton Bailey. Bristol: J. Wright and Sons, Ltd. 1930. Pp. xviii + 380. Price 25s.

This work will consist of two volumes.

This first volume, just published, deals with surgical emergencies in the abdomen and pelvis. It will be followed by a second volume dealing with the surgical emergencies of the head, neck, spine, thorax and extremities.

The first volume may be classed with those which are really practical and helpful. It is of a comfortable size to read, very well got up, and the numerous illustrations are extremely good and explanatory.

It is full of practical details, and, although one may not always be in favour of the technique described, this is always full of sound surgical common sense.

About one-third of the volume is given to the most important subjects of intestinal obstruction and strangulated hernia. There are also sections on the emergency surgery of the female generative organs, a very useful

chapter on "some post-operative complications," and an instructive chapter on kidney injuries and emergencies. A full and most useful bibliography is given at the end of the book. Possibly this might be more noticeable and useful at the end of each section.

We feel that this is a book really worth studying and look forward with great interest to the publication of the second volume.

A COMPENDIUM OF AIDS TO FIRST-AID. By N. Corbet Fletcher, M.A., M.B., M.R.C.S. Seventh Edition. London: John Bale, Sons and Danielsson Ltd. 1930. Pp. 70. Price 1s. net.

Students of first aid will find in this book a great deal to help them in the mastery of the St. John Ambulance textbook for the purpose of teaching or passing examinations. The author has arranged the matter in tabular form and has provided a large number of tips and mnemonics which can be commended so long as they are not substituted for an intelligent understanding of the subject. In preparing this seventh edition the author has been able to make a complete revision of the book.

SURGICAL EMERGENCIES IN PRACTICE. By W. H. C. Romanis, M.A., F.R.C.S., and Philip H. Mitchiner, M.D., F.R.C.S. London: J. and A. Churchill. 1931. Pp. vii + 608. Price 18s.

As the authors of that excellent textbook, "The Science and Practice of Surgery," Mr. Romanis and Mr. Mitchiner are well known. I must confess to a sense of a disappointment after reading this book; possibly one expected too much after the exceptional way in which the previous volume was presented.

In their preface the authors state that their excuse for the book is that practitioners have no time to wade through standard textbooks when confronted with an emergency. I cannot agree that this book is blameless in this respect. The detail given for any serious emergency is not really easier to find than in most textbooks and in my opinion is not given in such a way as to help very much a worried surgical tyro.

Much of the subject matter can hardly be classed as "emergency," as for example a short article on artificial limbs.

If the book had been more of the type of "What to do and how to do it in an emergency" I feel that it would have been of greater value. As it is, the book is well written and illustrated, and makes very interesting reading.

J. H. M. F.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LIST OF BOOKS RECEIVED DURING THE QUARTER FROM OCTOBER 1 TO DECEMBER 31, 1930.

Authors	Title of Work	How Obtained
Medical Research Council	System of Bacteriology. Vol. VIII. ..	Library Grant
India Office	Fauna of British India. Vol. VIII. Birds	India Office
Rose & Carless ..	Manual of Surgery	Library Grant
Brown & Hilton ..	Physiological Principles in Treatment ..	,, ,,
Bayliss	Manual of Helminthology	,, ,,
De Lee	Obstetrics	,, ,,
Williams	Obstetrics	,, ,,
Osler (McCrae) ..	The Principles and Practice of Medicine	,, ,,
Jordan	Textbook of Histology	,, ,,
Taylor (Poulton) ..	Practice of Medicine	,, ,,
Lee	The Microtomist's Vade Mecum ..	,, ,,
Beeston	The Conjoint Finals	,, ,,
Treves & Wakeley ..	Handbook of Surgical Operations ..	,, ,,
Clough	Diseases of Blood	,, ,,
Glendening	Modern Methods of Treatment ..	,, ,,
Ministry of Health ..	Departmental Report on Maternal Mortality & Morbidity	Ministry of Health
,, ,,	Report of the Committee on Vaccination	,, ,,
N.Y. Academy of Medicine	Outline of Preventive Medicine ..	Library Grant
Kromayer	Cosmetic Treatment of Skin Complaints	,, ,,
Lyle & Souza	Manual of Physiology	,, ,,
Haldane	Enzymes	,, ,,
Robinson & Jameson ..	Surface Anatomy	,, ,,
Tidy	Synopsis of Medicine	,, ,,
Short & Ham	Synopsis of Physiology	,, ,,
Bourne	Synopsis of Midwifery & Gynæcology ..	,, ,,
Nankivell	Synopsis of Hygiene & Public Health ..	,, ,,
Andrews	Diseases of the Skin	,, ,,
Stewart	Recent Advances in Organic Chemistry. 2 vols.	,, ,,
Hull	Diseases transmitted from Animals to Man	,, ,,
Voltz	Dosage Tables for Röntgen Therapy ..	,, ,,
Currie	Textbook of Hygiene	Library and Journal Committee
St. Bart's. Hosp. ..	Hospital Reports. Vol. LXIII ..	St. Bartholomew's Hospital
,, ,,	Deep X-ray Therapy in Malignant Disease	,, ,,
Drummond & Hilditch ..	The Relative Values of Cod-Liver Oils from Various Sources	Empire Marketing Board

Notices.

SIXTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY, THE HAGUE, JUNE 15-20, 1931.

PROVISIONAL PROGRAMME.

Sunday,	*June* 14.	17 hours.	Meeting of Permanent Committee.
Monday,	*June* 15.	9 ,,	Issue of badges and documents.
			Meeting of Heads of Delegations and National Correspondents.
		14.30 ,,	Official Opening Ceremony and opening of Historical Exhibition.
		19 ,,	Dinner to Official Delegates given by the Netherlands Government.
Tuesday,	*June* 16.	10 ,,	Meeting of all sections.
		15 ,,	*First Question.* The Recruiting, Training, and Advanced Training of Military Medical Officers and Pharmacists. Nomination of a committee to draw up conclusions.
		21 ,,	Reception.
Wednesday,	*June* 17.	10 ,,	*Second Question.* The Psychoneuroses of War, the Immediate and Remote Effects on the Nervous System of War in Combatants and Non-Combatants.
			Fourth Question. The Preparation and Storage of Medicinal Ampoules in use in the Medical Services, both Naval and Military. Nomination of a committee to draw up conclusions.
		17 ,,	Tea given by the Red Cross Society to Heads of Delegations.
Thursday,	*June* 18.	10 ,, and 15 ,,	*Third Question.* Methods of Hæmostasis on the Battlefield. Standardization of First Aid Material and the Mode of Application. Nomination of a committee to draw up conclusions.
			Fifth Question. The After-effects of War Wounds of the Teeth and Inferior Maxilla: their Treatment. Nomination of a committee to draw up conclusions.
		14 ,,	Meeting of Permanent Committee.
		21 ,,	Government Reception.

Friday, June 19. Excursion.
Meeting of Permanent Committee.
Discussion of conclusions and preparation of agenda for the final meeting.

19 hours. Banquet (subscription 10 florins).

Saturday, June 20. 10 ,, Final general meeting.

Subscriptions. 10 Dutch florins (16s. 8d.) for members of the Congress; 5 florins for members of the family.

Uniform. The wearing of uniform is optional. For official receptions and evening ceremonies full-dress uniform with decorations is recommended.

Excursions. Additional excursions for three, four, or five days to various parts of Holland are being arranged by Messrs. Thomas Cook and Son, Ltd.

Reduced Fares. The following reductions in railway fares have been arranged:—

In Great Britain. Single fare and a third for the return journey.
France. 50 per cent reduction.
Belgium. 35 per cent reduction on railways and steamers.

The Southern Railway have arranged for special fares to The Hague via Victoria, Gravesend and Rotterdam by the Batavier Line. Return fare to The Hague: 1st class—£3 11s. 8d.; 2nd class—£2 12s. 9d.

The latest date for receiving subscriptions and for receiving communications on the subjects under discussion is May 15, 1931.

——

THE SECOND GARTON PRIZE AND MEDAL.

Particulars of Rules and Regulations to which all Candidates must Subscribe.

The Prize and Medal has been instituted by the Grand Council of the British Empire Cancer Campaign with the object of promoting investigations into the Nature, Causes, Prevention and Treatment of Cancer.

A Medal (suitably inscribed and engraved with the seal and motto of the Campaign), together with an honorarium of £500, will be awarded to the person or group of persons who shall submit the essay embodying the results of original investigations which, in the opinion of the Judges, appointed by the Grand Council of the British Empire Cancer Campaign, is the best contribution towards the biological effects and mode of action of radiations upon malignant and other cells.

In the event of several dissertations of sufficient merit being submitted, the Prize may be divided, or additional awards made.

The Prize will be reserved if, in the opinion of the Council, no dissertation of sufficient merit be received.

Candidates, who may be of either sex, must be British subjects domiciled in the British Empire and not at the time members of the Grand Council of the British Empire Cancer Campaign.

The honorarium may be awarded either to an individual or to a group of persons who jointly submit a dissertation.

The dissertations shall be printed or typewritten in English, and embody the results of original investigations carried out, either wholly or in part, during the three years immediately preceding the year in which the prize shall be awarded.

The dissertations shall not bear the name of the author or authors, but shall be distinguished by a motto or device, and be accompanied by a sealed envelope containing the name and address of the author, and having on the outside the motto or device corresponding with that on the dissertation.

The dissertations shall be addressed to the Honorary Secretary, British Empire Cancer Campaign, 12 Grosvenor Crescent, Hyde Park Corner, London, S.W.1, and be delivered not later than December 31, 1933.

The Prize dissertation (with all accompanying illustrations and preparations) shall become the property of the British Empire Cancer Campaign, and shall be published at their discretion under the name of the author or authors.

Dissertations not approved for a Prize shall, upon authenticated application within three years of the award on the specified subject, be returned together with the unopened envelopes containing the names and addresses of the authors.

The award of the Second Garton Prize and Medal will be made early in 1934.

THE JUNIOR RED CROSS.

THE Junior Red Cross is part of the National Red Cross, and fosters in the young the ideal of service that inspires the parent Society.

Junior Branches are organized by the National Red Cross Societies of forty-three countries, with a membership of 12,000,000 boys and girls.

The Junior Branch exists mainly as a voluntary movement in schools, but may be co-ordinated, by means of its Link formation (or through Junior Red Cross Courses in First Aid, Home Nursing and Hygiene) with other Juvenile organizations—Scouts, Guides, Guildry, Life Brigades, etc. Its aim is to co-operate with teachers and others in those matters with which the Red Cross is especially concerned, namely, the Promotion of Health, Help to the Sick and Suffering, and an International Bond of Service.

It encourages among children the habits of healthy living, and the sense of social responsibility.

Motive and interest, sources of inspiration and action, are found in the high tradition and ideals of the Red Cross, which appeal to the imagination of the child, and by the knowledge of what is being done by members of the Junior Branch throughout the world to take their part in their own way and degree in Red Cross activities. This knowledge is diffused by the Junior Red Cross Journals, and by an interesting scheme of inter-school correspondence.

The Junior Red Cross has no outside rules or regulations. Its code is expressed in its motto : "Serve one Another." Its objects are everywhere the same—Health, Help to the Sick and Suffering, A Chain of Service.

MEDICAL SUPERINTENDENT.

A VACANCY will shortly occur at the Royal Victoria Hospital, Belfast, for a Medical Superintendent.

Applicants must not be over 55 years of age on date of appointment and must possess experience in hospital administration and organization.

Salary £500 per annum, with free house, coal and light. Age on retirement 65.

Applicants should also state how soon they would be free to take over in the event of being selected for the appointment.

Letters of application stating age, experience, etc., with references, should be addressed before March 31, 1931, to the Honorary Secretary, from whom further information can be obtained.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1, payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—
G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C. 2.

VOL. LVI APRIL. 1931. No. 4.

Journal

of the

Royal Army Medical Corps.

Original Communications.

A NEW ORGANISM CAUSING PARATYPHOID FEVER IN INDIA, SALMONELLA TYPE "BAREILLY."

BY MAJOR R. F. BRIDGES,
Royal Army Medical Corps.

AND

W. M. SCOTT, M.D.,
Medical Officer, Ministry of Health.

INTRODUCTORY.

THE interest taken in the Salmonella group during recent years has resulted in the definition of many antigenic types, the status of which is as clearly independent as that of the commoner types associated with the enteric group of fevers and with acute gastro-enteritis. Though this multiplicity of types has increased the amount of necessary preparatory work in the organization of routine bacteriological tests, it has also increased its interest; while the discovery by Andrewes (1922, 1925) of the phase phenomenon has freed serological identification from the anomalies which formerly made it so unsatisfactory.

It is known that the bacteria comprising the Salmonella group are divisible into several categories, according to the nature of their heat-labile flagellar antigens. These are, firstly, the monophasic permanently specific types, of which the *Bacillus typhosus* and the *B. paratyphosus* A are examples. In the case of these organisms, owing to the specific character of their heat-labile antigens, simple agglutination tests suffice for their identification. Secondly, a number of monophasic permanently non-specific strains or types have been demonstrated, among which may be

mentioned the Binns strain of Schütze (1920) and the European variety of the *B. suipestifer*. Organisms belonging to this category appear to have lost, or may never have developed, the capacity to produce specific antigen. They may be identified by their persistent failure to produce specific colonies, and by the proof of serological identity of their antigen with the group antigen of the related type.

Thirdly, there is the group of diphasic organisms which includes the *B. paratyphosus* B and C, the *B. aertrycke*, the *B. newport* and a number of others. In the case of these organisms their colonies, or the growth produced in first subcultures from them, may be either in the specific phase, in which simple agglutination tests suffice to identify the type, or in the group phase, in which serological tests merely indicate that the strain is one of the numerous Salmonellas capable of infecting man. Fortunately, strains in the group phase usually provide type phase colonies after a few subcultures. Exceptions, however, occur in which more artificial procedures may be necessary, such as subculture in liquid media containing group agglutinin. This obstinacy in the group phase appears to be characteristic of the Thompson type (Scott, 1926).

Finally, mention must be made of the Meta-Salmonella types, in which the different strains are completely devoid of heat-labile flagellar antigen. Such organisms are permanently non-motile and can only be differentiated by a study of their somatic heat-stable antigens.

Laboratory Methods.

In practice, therefore, when a motile organism, which is suspected to belong to the Salmonella group, is discovered in cultures, specific colonies are first to be searched for. This may be done by picking off colonies into broth and testing the resulting cultures for agglutination with anti-Salmonella type serums, or with a pure group serum such as may be prepared from the Binns strain or the European *B. suipestifer*. When type serums are used for the test they must be known to contain a moderate amount of group agglutinin in addition to the type specific agglutinin.

At the Enteric laboratory in Kasauli, where the Bareilly strains which form the subject of this note were first studied, it was the practice to use two serums, one prepared against *B. paratyphosus* B and the other against *B. paratyphosus* C (Hirschfeld). These serums contained a sufficient amount of group agglutinin to agglutinate the group phase of any of the diphasic Salmonellas to about twenty-five per cent. of their full titres. Using Dreyer's technique, each serum was put up with the unknown culture as a single tube test in a dilution equivalent to five per cent of its specific titre, and therefore well within the non-specific zone. Any culture agglutinating with both B and C serums in this dilution must be in the group phase; agglutination with B but not with C serum, or with C but not with B serum, affords immediate indication of the probable type; while

any culture which fails to agglutinate with both serums is probably the specific phase of some other Salmonella type.

If the search for group and specific colonies be carried out with the help of a pure group serum, a suitable dilution for the test is ten per cent of the titre.

In the laboratory of the Ministry of Health, where the Bareilly strains have been further studied, the "drop method" of preliminary identification is in use. In this method drops of diluted agglutinating serum are placed on a glass slide and a minute particle of the culture, obtained by touching a colony with a platinum needle, is emulsified in a drop under the X 6 lens of a dissecting microscope. Agglutination is shown on stirring or rocking the drop by the change from a uniform emulsion to one containing obvious floccules. Auto-agglutinability or that due to O agglutination should cause no difficulty to the experienced eye. It is customary to employ parallel rows of drops: one row consisting of group Salmonella serum, prepared from European *B. suipestifer*, in a dilution equivalent to two to five per cent of its titre; and other rows of similar dilutions of specific serums of the types likely to be encountered. The first colony which fails to clump in the drop of group serum, but clumps in typical fashion in one of the specific drops, is identified as a specific colony of the type with which the latter serum was prepared.

Should a specific colony not be found among those on the primary plate, one of the group colonies should be subcultured a few times in succession before replating and repeating the search for colonies in the specific phase.

In all cases conclusive identification must be based on careful titration with specific type serums and on the results of absorption of agglutinin from these with the unknown strain. Any anomalies in its behaviour necessitate the preparation of agglutinating serums with its group and specific phases and the application of "mirror" absorption tests. The behaviour of the heat-stable antigen and its agglutinin must also be examined, to complete the antigenic picture.

The Source of the Bareilly Strains.

The three strains of the type which we have studied were all isolated in the Brigade laboratory at Bareilly, the first two in August, 1928, by Major A. Y. Dabholkar, M.C., and the third in April, 1929, by Captain J. F. O. Bodman, both of the Indian Medical Service. Subcultures, which were sent to the Enteric laboratory at Kasauli in accordance with the usual procedure, were stated to have been isolated: (1) from the blood of No. 1754, rifleman Nanji Gam, (2) from the fæces of No. 1712, rifleman Kyang Lup, and (3) from the blood of No. 1126, rifleman Diram Min; these three men all belonged to the 2/20th Burma Rifles. We have called the strains accordingly N.G., K.L., and D.M. A fourth strain of the same type

was also isolated at Bareilly from a man in a different unit; it was unfortunately lost while under examination in Kasauli.

The clinical type of illness during the course of which these organisms were isolated was similar in the three cases. There was a continued pyrexia of from eight to twelve days' duration, the temperature not exceeding a maximum of 103° F. It was associated with slow pulse-rate, headache, constipation and mild bronchitis and was, in fact, characteristic of the mild enteric fevers of India. The circumstances of the third case were interesting: the regiment was stationed at the time at an outlying cantonment, when an outbreak of fever occurred affecting twenty men of the unit almost simultaneously. In the majority of the cases the symptoms were so mild that the patients were treated locally and had completely recovered in a few days. Three cases, however, were of sufficient severity to necessitate removal to the Indian Military Hospital at Bareilly; one of these was Diram Min, from whose blood came our strain D.M.

Serological Identification.

On examination at Kasauli the strains N.G. and K.L. were found, on their biochemical and serological reactions, to be members of the Salmonella group, but only group phase colonies could be obtained from them. A period of nearly three months elapsed, during which the organisms were passed repeatedly through broth, plated and tested in the manner described, before the failure of certain colonies to agglutinate with either B or C serum provided evidence that the specific phases of the organisms had at length been obtained. Broth cultures from such colonies also failed to react with serums of types Typhosus, Paratyphosus A, Enteritidis, Derby, Aertrycke, Newport, Stanley, Reading, and Morbificans Bovis.

Serums were then prepared with the specific phases of strains N.G. and K.L. These were found to show no agglutination, in dilutions equal to five per cent of their homologous titres, with broth cultures of seven monophasic Salmonella types: Typhosus, Paratyphosus A, Enteritidis, Derby, Dublin, Abortus equi and Dar-es-Salaam; and with the specific phases of ten diphasic types: Paratyphosus B, Paratyphosus C (Hirschfeld), Aertrycke, Newport, Stanley, Reading, Morbificans Bovis, Thompson, Sendai and L. On the other hand, the identity of strains N.G. and K.L. with each other was established by cross-agglutination and mirror-absorption experiments.

Though analysis of the antigenic composition was not yet complete, the above tests were sufficient to show that N.G. and K.L. belonged to a Salmonella type hitherto unrecognized; in accordance with custom the territorial designation "Bareilly" was given to the type.

The strain D.M. was received in the Enteric laboratory some months after the other two. It presented no difficulty in the separation of its

specific and non-specific phases, and was identified by agglutination and absorption tests as a third representative of the Bareilly type.

The Widal Reaction.

The agglutinin response of the three patients from whom these strains were isolated was not tested until some months after convalescence had been established. Each serum then agglutinated the group phase of its corresponding strain quite strongly, but only the serum of Kyang Lup agglutinated the specific phase and that to a titre of only 1 in 125. The absence of agglutinin for the specific heat-labile antigen in two cases is in accordance with observations in infections with other diphasic Salmonellas, in which, in human beings, group agglutinin may be in considerable excess over specific. In the present case, the long interval which had elapsed before the serums were tested gave opportunity for the disappearance of the minor specific agglutinin.

A test was also carried out with the serum of Diram Min for agglutinin against the heat-stable antigen of D.M. Using an alcoholized suspension of D.M., this serum gave strong granular clumping in dilutions up to 1 in 250. The presence of agglutinin for the heat-stable antigen (O agglutination) in the one case tested is of interest, in view of the common parallel in infections with *B. typhosus,* in which development of O agglutinin may coincide with absence of agglutinin for the heat-labile H component. This phenomenon, however, is not confined to the Salmonella group, and it is therefore advisable in the case of all motile organisms to test the patient's serum for both H and O agglutinins before deciding that an organism isolated from that patient shall not be incriminated as a cause of infection.

Antigenic Analysis of the Bareilly Type.

As stated above, the diphasic nature of the Bareilly strains and the unique character of their specific heat-labile antigens had been established in India. It remained to examine in London the relationships of the group heat-labile and the heat-stable antigens. For this purpose specific and group serums of K.L. and unselected (mixed specific and group) serums of D.M. and N.G. were prepared. Pure O serums were also obtained by injecting into rabbits cultures of each of the three Bareilly strains grown on phenol agar (1 in 800) and heated for ninety minutes in current steam. The serums were prepared from smooth cultures only.

The Group Heat-labile Antigen.

In Table I, which is modelled on those of White (1925, 1926), the effect of successive absorptions on the K.L. group serum are set out as they affect the agglutination titre against emulsions of various type strains

First, the heat-stable agglutinin was removed by contact with *B. suipestifer* culture grown on phenol agar and steamed for ninety minutes.

Four 3½-inch plates provided the growth, which was emulsified in ten cubic centimetres of saline, to which had been added 0·2 cubic centimetre of the K.L. group serum. The dilution was thus 1 in 50. After standing overnight the bacteria were removed by the centrifuge.

TABLE I.—SHOWING RESULT OF SUCCESSIVE ABSORPTIONS ON BAREILLY K.L. GROUP SERUM.

Organism agglutinated: Type	Strain	Phase, &c.	Agglutination with Bareilly K. L. group serum	After absorption with heated phenol agar Suipestifer culture	Further absorbed with Paratyphosus B group culture	Further absorbed with Aertrycke group culture	Further absorbed with Suipestifer group culture	Further absorbed with Bareilly D.M. culture	Further absorbed with Bareilly N.G. culture
Bareilly	K. L.	Specific	6,500	6,500	6,500	6,500	6,500	< 100	< 100
		Group	25,000	25,000	25,000	25,000	6,500	< 100	< 100
		O	1,600	100	100	100	< 100	—	—
Para C	Hirschfeld	Specific	< 200	—	—	—	—	—	—
		Group	25,000	25,000	25,000	25,000	< 100	—	—
		O	1,600	< 100	—	—	—	—	—
Thompson	Thompson	Specific	< 100	—	—	—	—	—	—
		Group	25,000	25,000	25,000	25,000	< 100	—	—
		O	1,600	< 100	—	—	—	—	—
Aertrycke	Mutton	Specific	< 200	—	—	—	—	—	—
		Group	3,500	3,500	200	< 100	—	—	—
		O	< 100	—	—	—	—	—	—
Newport	Newport	Specific	< 200	—	—	—	—	—	—
		Group	3,500	3,500	200	< 100	—	—	—
		O	< 100	—	—	—	—	—	—
Para B	"15"	Specific	< 200	—	—	—	—	—	—
		Group	3,500	3,500	< 100	—	—	—	—
		O	< 100	—	—	—	—	—	—

It will be observed that this treatment had no effect on the agglutinating titre for any of the emulsions except those of the O variety, which had been prepared from smooth cultures by extracting (twice) the growth on phenol agar with absolute alcohol and suspending in saline. Of these O emulsions only types Bareilly, Paratyphosus C and Thompson showed appreciable agglutination with the unabsorbed serum, and the treatment with heated phenol agar *B. suipestifer* culture removed practically all agglutinin, thus eliminating possible confusion in agglutination tests after further absorption.

The next absorption, with two plates of group phase *B. paratyphosus* B culture, had no perceptible effect on the agglutination with types Bareilly, Paratyphosus C and Thompson, but greatly reduced that for types Aertrycke and Newport, and of course abolished that for type Paratyphosus B. Absorption of the remaining serum (now six cubic centimetres), with one plate of group phase *B. aertrycke*, had again no perceptible effect on the first three types, but abolished agglutination for both types Aertrycke and Newport.

There remained three cubic centimetres of absorbed serum, and this had now added to it the growth from two agar slopes of European *B. suipestifer*. The result was to reduce the titre to the same level (1 in 6,500) for both specific and group phases of the Bareilly type, and to abolish agglutination entirely at 1 in 100 for types Paratyphosus C and Thompson. The final absorption with mixed phase culture of D.M. and N.G. simply confirms the reciprocity of K.L. specific agglutinin with the specific antigens of the other two representatives of the Bareilly type.

Other absorptions were carried out, full details of which need not be given. Primary absorption with group *B. aertrycke* culture abolished agglutination for both types Paratyphosus B and Newport. Primary absorption with group *B. suipestifer* left agglutinin for type Paratyphosus B at 1 in 100, but not at 1 in 250; for types Aertrycke and Newport at 1 in 250 but not at 1 in 500, and removed agglutinin entirely for type Paratyphosus C, at the same time reducing the titre for group phase K.L. to 12,000 and scarcely affecting the titre for K.L. in its specific phase.

The Heat-stable Antigen.

The O serums which had been prepared showed no perceptible flocculating H agglutinin, but produced characteristic granular agglutination with formation of dense clumps, not readily broken up on shaking.

Table II.—Showing Results of Absorption of O Agglutinin from Bareilly, K.L., D.M. and N.G. Serums.

Organism agglutinated O emulsions	Agglutination with K.L. O serum				Agglutination with D.M. O serum				Agglutination with N.G. O serum			
	Unabsorbed	Absorbed with			Unabsorbed	Absorbed with			Unabsorbed	Absorbed with		
		K.L.	D.M.	N.G.		K.L.	D.M.	N.G.		K.L.	D.M.	N.G.
K.L.	1,600	<100	<100	<100	3,000	<100	<100	<100	800	<100	<100	<100
D.M.	1,600	<100	<100	<100	6,000	3,000	<100	200	800	<100	<100	<100
N.G.	1,600	<100	<100	<100	6,000	<100	<100	<100	800	<100	<100	<100
Para B ..	<100	—	—	—	100	—	—	<100	<100	—	—	—
Aertrycke ..	<100	—	—	—	100	—	—	<100	<100	—	—	—
Para C ..	1,600	—	—	—	3,000	—	—	<100	800	—	—	—
Newport ..	<100	—	—	—	<100	—	—	<100	<100	—	—	—

Table II shows some of the results obtained by cross-agglutination and absorption, using in each instance emulsions and culture masses devoid of the heat-labile H component. It will be observed that the results indicate a close similarity in the O component of the three Bareilly strains, and that this element approximates in behaviour to that of *B. paratyphosus* C. But the serum D.M., the titre of which is considerably higher than the other two, appears to contain an additional agglutinin, presumably corresponding to an additional heat-stable constituent, not present or perhaps weakly represented in K.L. and N.G.; for D.M. serum cannot be robbed completely of its homologous O agglutinin by either of the others, and in fact K.L. reduces the titre only by about one-half. The remaining agglutinin, after absorption by K.L., is not related to that of any other Salmonella types tested; it fails to agglutinate, in addition to those in the table, *B. typhosus*, *B. paratyphosus* A and *B. enteritidis*, all of which, in any case, show only traces of agglutination in these Bareilly serums unabsorbed.

Absorption experiments with these Bareilly serums, using O culture of *B. suipestifer*, confirm the close similarity of their heat-stable components; practically all agglutinin is removed for the homologous O emulsion in the case of K.L. and N.G. But, again, there remains a respectable amount of agglutinating power in the case of D.M. serum for D.M. itself, though all has been removed from this serum for K.L. and N.G.

The conclusion is that the heat-stable components of the Bareilly type are, for the most part, the same as those of *B. paratyphosus* C, but that some constituent must be present peculiar to the type, in small amount in K.L. and N.G., but fairly abundant in D.M. Similar variations can be observed in the O composition of different strains of other types, and their full range and meaning form a subject worthy of careful study.

To rank the Bareilly type with the other Salmonellas, we can now, using the notation of White (1926), express its antigenic composition as follows:—

Stable O (somatic) factors ..	..	V (+ ?)
Labile H (flagellar) factors—		
group phase ..	..	G, A, B, C, E 1 and 2
specific phase ..	..	Bareilly specific

The type is related to the *B. paratyphosus* C in its labile group phase and stable antigens, but possesses a wider range in the composition of the former, and has some antigen peculiar to itself in the latter.

Biochemical Reactions.

All three Bareilly strains, when tested in London, behaved alike in their capacity for fermenting the carbohydrates employed.

Table III.

Strain	Glucose	Mannitol	Dulcitol	Arabinose	Rhamnose	H_2S test
K.L.	A.G.	A.G.	A.G.	A.G.	A.G.	+ + +
D.M.	A.G.	A.G.	A.G.	A.G.	A.G.	+ + +
N.G.	A.G.	A.G.	A.(G).	A.G.	A.G.	+ + +

It will be observed that they resemble the *B. paratyphosus* C in producing abundant H_2S (lead acetate test), but differ from it in their more active fermentation of rhamnose. They differ decidedly from *B. suipestifer*, European and American, in their active fermentation of arabinose and dulcitol, and from American *B. suipestifer* in their powerful production of H_2S. They show no sign of "slime-wall" formation in colonies kept at room temperature after incubation.

Summary.

A Salmonella of a new serological type is described. Three strains have been examined, all isolated from mild cases of enteric fever. The name proposed is "Bareilly." The strains are deposited in the National Collection of Type Cultures.

REFERENCES.

Andrewes, F. W. (1922). *Journ. Path. and Bact.*, xxv, 505.
Idem, (1925). *Ibid.*, xxviii, 345.
Schütze, H. (1920). *Lancet*, i, 93.
Scott, W. M. (1926). *Journ. of Hygiene*, xxv, 398.
White, P. B. (1925). Sp. Rep. Ser., Med. Res. Coun., No. 91.
Idem. (1926). *Ibid.*, No. 103.

MEDICAL INTERCOMMUNICATION ON ACTIVE SERVICE.[1]

By Major R. E. BARNSLEY, M.C.,
Royal Army Medical Corps.

I feel that I should preface my lecture to-night with an apology and an explanation.

An apology is due on account of the very elementary nature of the material which I propose to put before you; a large amount, if not all of it, is already quite familiar to you.

I should like to add by way of explanation, however, that some of the practical and elementary lessons which we learned by dint of long and bitter experience during the Great War seem to be in danger of being forgotten in our present striving after specialization and technical efficiency.

Of these lessons none is of greater importance than the necessity of instructing medical officers, warrant officers and non-commissioned officers in the sending of messages in a short, simple, standardized and easily understood form.

These messages have always been, and must always be, an essential link in any system of evacuation of wounded; it matters not whether we are fighting on our feet or in motor cars, whether we are struggling on the sea or battling in the central blue. And yet, in official handbooks, you may search in vain to find the matter dealt with from the point of view of the junior medical officer or senior N.C.O.

At one end of the scale we find our rank and file admirably catered for. All, and possibly more than all, they may require is to be found between the covers of the Manual. In this all-embracing work the soldier can study the subtleties of the sympathetic nervous system or the methods of carrying wounded across the frozen wastes of Russia, he can master the intricacies of "raising the canvas and approximating poles" or enter into the mysteries which go to the concoction of a depressing beverage known as "Egg Nog."

At the other end of the scale we have, as officers, our staff rides and tactical exercises when for the time being (and probably for the only time in our lives) we become D.D.'sM.S. and A.D.'sM.S., and spend profitable afternoons in the country hurling casualty clearing stations and general hospitals with light-hearted nonchalance from one end of the country to the other.

Few of us can ever hope to reach these Olympian heights in real life, but between the two extremes there is an enormous field for peace-time training and discussion which may help to fit us to carry out the duties of

---

[1] A lecture for junior Officers and senior N.C.O.'s given at the Royal Army Medical College on November 6, 1930.

those who are the keystones of our war-time organization, the efficient Regimental and Field Ambulance medical officer.

It is, therefore, to the junior officer, the W.O. and senior N.C.O. that my remarks this evening will be mainly addressed.

Now before we embark upon our subject proper it is of the greatest importance that we should all get a clear idea as to the essential differences between operation orders and field messages, and you will perhaps forgive

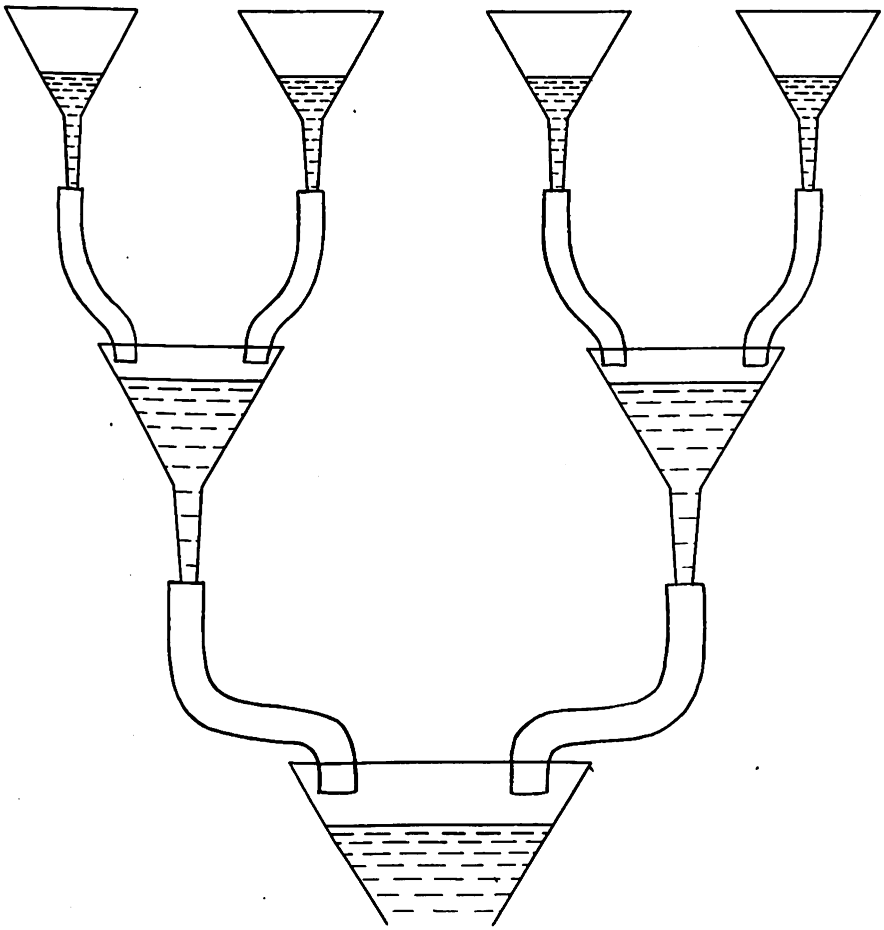


Fig.

me if I try to emphasize the differences by a somewhat kindergarten method.

The apparatus you see before you (see fig.) (which, I must confess, looks as though I had had the benefit of the collaboration of Mr. Heath Robinson) is intended to illustrate a portion of a system of evacuation. Each of the small funnels represents an Aid Post, the larger ones Advanced Dressing Stations, the large one a Main Dressing Station, and so on.

The narrow tubing which empties the Aid Post represents the thin trickle of wounded which comes down by hand carriage, and it will be seen that two of these empty into the A.D.S. It follows therefore that, to prevent an overflow in the A.D.S., we shall require at least the same amount of narrow tubing (or an equal number of stretcher bearers) or, better still, one tube of wider lumen. This larger tube may be said to represent wheeled transport of any kind which can reach the A.D.S. at some time during the twenty-four hours.

In exactly the same way the M.D.S. must be kept clear by still wider tubing, indicating motor ambulance cars; tubes of increasing calibre, through C.C.S.'s to the General Hospital, would represent ambulance trains, ships, and so on.

A moment's thought, therefore, will show us the fundamental principles of evacuation in war.

(1) That the various forms of ambulance transport must increase in speed and efficiency as evacuation proceeds from front to base.

(2) As a corollary to this, that each form of ambulance transport must be exploited to its fullest extent and brought as near to the front line as the tactical situation allows.

(3) That all medical posts and units should, as far as possible, be situated at points where transition from one kind of transport to another takes place.

Applying these principles into actual practice we find that :—

(*a*) Aid Posts should be at the nearest point to the front line where relative safety of the wounded can be secured and information regarding the situation in the sector can be obtained. This is, of course, generally in the neighbourhood of battalion headquarters.

(*b*) Advanced Dressing Stations should be at the nearest point to the Aid Posts which is accessible by wheeled transport at some period during the twenty-four hours.

(*c*) Main Dressing Stations should be at the nearest point to the A.D.S. which is accessible by motor transport during the whole twenty-four hours.

(*d*) Casualty Clearing Stations should be at the nearest point to M.D.S.'s accessible by ambulance train.

(*e*) General Hospitals have their situation regulated by general considerations, such as the proximity of Convalescent Depôts, Rest Camps, Quays, etc.

Now Operation Orders issued prior to an attack may be said to be the plan setting out in detail this apparatus, and I wish that I could convey to those of you who have not had war experience the painful and protracted labour which results in the birth of such an order. For days, and perhaps weeks, Field Ambulance Commanders have scoured the area until they are familiar with every track, nullah and covered way. An infinity of detail, such as water, rations, gas arrangements, equipment, accommodation, disposal of arms, disinfection, and a thousand other things have to be

arranged. Up at Divisional Headquarters the A.D.M.S. spends long hours with his D.D.M.S., the Field Ambulance Commanders, G., Q. and A. departments, while his luckless D.A.D.M.S. strives manfully to co-ordinate in the form of an intelligible order the flood of instructions that pour in upon him. At about 10 o'clock at night, when he hopes he has almost succeeded, his chief returns, tired and slightly irritable, alters all the dispositions, and the typewriters once again are set clattering away until the dawn. Finally, however, the apparatus is set, and all is prepared to the proverbial last button.

If all proceeded accorded to plan, the flow of wounded through the various posts would be the steady, orderly stream which you see passing through this apparatus, and no further adjustments would be necessary ; in practice, however, this is seldom, if ever, the case.

If I wished to present to you the events which are likely to occur when the attack has been launched, I should fill up one funnel from a bucket, another possibly from a teaspoon, I should have to push one forward and draw another back, and, to complete the picture, I should arm the back row of my audience with a goodly supply of brickbats and urge them to subject the whole apparatus to a lively bombardment.

Under these conditions, if the flow is to be maintained, modifications are constantly needed which cannot possibly be carried out without a complete knowledge of the events occurring in each post and line of evacuation.

Imagine now that, in the midst of this pandemonium, some evil-minded person turned off the light, and you will get some idea of the plight in which an administrative officer finds himself if deprived of the light shed upon the situation by the field messages he should receive from forward areas.

We see, therefore, that the operation order sets up the apparatus, while the field messages passing backwards and forwards regulate the flow of wounded in conformity with the ever-changing situation.

Zero hour arrives, the barrage lifts, and the fog of war descends.

From this moment the only rays which filter through the gloom to your Commander are the field messages which you are able to send back.

It is true that when things are going well, your Divisional and Brigade Staffs will be of the greatest help, but it is when things go awry that casualties occur. At such times all the energies of the staff are bent upon restoring the military situation, and we cannot expect that any large part of their time can be devoted to our medical problems. Do not think, too, that information of any value can be obtained from the wounded as they pass through. A private soldier sees only an infinitesimal part of the battle and the loss of a couple of his comrades is often enough to persuade him that the entire battalion has been wiped out.

When you are writing your operation order, you have many things in your favour. You have, at any rate, a table, a chair and a reasonable

amount of light. You can get food with some regularity; you can keep moderately warm. When, however, you are in an aid post or advanced dressing station, circumstances may be very different. Your light may be a candle which promptly goes out whenever a shell bursts outside, or, at best, may be a hurricane lamp or two. Perhaps you are soaked to the skin, dirty, unshaven, cold and hungry. You are surrounded by wounded men in pain; may be you are further handicapped by wearing a respirator; shell bursts and machine-gun bullets may be far too close to be pleasant; and, unless you happen to be one of Miss Dell's steely-eyed, thin-lipped heroes, you are in a very considerable state of wholesome funk.

Under these conditions it is no easy matter to concoct a clear and dispassionate message for your C.O., and I maintain that it cannot be done unless we practise in peace time until it becomes almost a second nature. And yet, if it is not done, chaos and disaster will inevitably follow.

In order to illustrate the actual form of field messages, I think one cannot do better than take a hypothetical case; let us invent a situation and then examine various forms of message which might be sent. Such a situation I have put down in the papers before you:—

Situation.

The time is 11.30 a.m., the attack began at daybreak this morning. Captain Green is in charge of an advanced dressing station in which are the following casualties: 2 G.S. wounds, abdomen; 1 fracture, both bones of leg; 5 superficial wounds, head chest and arms; 1 G.S. wound, chest; 2 cases of dysentery; 2 shell wounds of feet; 1 fractured skull; and 1 Pott's fracture.

He is also in need of additional dressings, etc.

At the same time he hears that the M.O. attached to the 1st Blankshires has been killed, and decides to send one of his officers in relief.

Let us imagine that Captain Green is a temporary officer straight from hospital and hurled half-trained into the field. As likely as not he will send that most disastrous of all communications, the *verbal message*.

He has just finished putting up the Pott when he sees a Lance-Corporal leaving for the main dressing station with some walking wounded. He calls after him, "When you get back, Corporal, ask the Colonel to send along some transport and evacuate us as soon as possible."

What is the result?

On the way down the Corporal is called to another case; he tells another bearer to give the message, which is duly delivered in the form, "Transport is wanted at the A.D.S."

Some such conversation as this follows:—

"Which A.D.S.?"

"The one near the broken tree."

"But there are broken trees near each of them!"

"The one I went to first thing this morning."

"How many were there to evacuate?"

"The Corporal didn't tell me."

"Who was the officer?"

"I don't know, I only arrived yesterday."

(I wonder if, like me, you are constantly struck by the amazing phenomenon that nine-tenths of the army "only came here yesterday"; whenever awkward information is required or unpleasant deficiencies of kit are to be explained, the same cry goes up. I often think the entire British Army must be in a constant state of "general post.")

To make a long story short, in all probability the wrong transport goes to the wrong place, and confusion results.

As a result of this contretemps, our gallant Captain decides that all messages must be in writing, and the next time he is similarly placed he hurriedly scribbles a "panic" message such as this:—

To Col. Traverse.

ADS full up; send all transport as soon as possible, very urgent.

P. Green.

Or, worse still, a cheery, inconsequent note such as this:—

To Col. Traverse.

Am having a pretty mouldy time, but all OK, what about sending up the old charabangs? and don't forget the rum. I hear poor old Slings has stopped one.

Yrs

P. Green.

Now such messages as these are almost as bad as the verbal variety, and I can assure you that they are no exaggeration. Let us consider a few of the more glaring faults and draw our conclusions from them.

(1) *Never address a message to an officer by name.*

Colonel Traverse may be dead or he may be six hours away up the line. You are addressing your unit, and whoever is acting as C.O. must deal with your difficulty. "22 Fd.Amb." is all that is required. A message such as the one we are considering is given to an orderly, who gets back to camp, reads the address and says to the first man he sees, "I have got a chit for the old man, have you seen him about?" "He was down in the transport when I last saw him." In the transport lines he is told that he has gone to brigade, thence the message may follow him to division, divisional train, and finally run him to earth some hours later in the operating theatre.

In the meantime, our Captain Green, who has lived with a battalion for so long, and has developed into such a tremendous soldier that he is never tired of inveighing against the branch of the Service to which he belongs, is probably pouring forth a tale of woe to a Brigadier or Battalion Commander, "Three hours ago I sent an urgent requisition for transport and nothing has happened! It is quite time they got rid of some of these old Regular Dug-outs and gave a chance to young men with fresh ideas."

(2) *Never omit to time your messages.*

In the case we are considering, the Colonel, when he finally receives the message has no idea when it was sent. Perhaps some transport had been sent an hour before. Was the note sent before its arrival or are there men still to be brought away? Probably more men and animals are sent to risk their lives in going to an empty advanced dressing station, while at another one crowds of seriously wounded may be crying out for transport.

(3) *Never put in extraneous information without making clear what action has been, or is to be taken.*

In this case we have certain information about "poor old Slings," and the following questions at once arise. Is he killed or wounded? Is a relief necessary? When did it happen? Does Brigade Headquarters know? What is the source of information?

(4) *Never ask for transport without giving definite information as to the numbers for evacuation.*

As the weeks drag on our Captain really tries to profit by experience, and on the next occasion sends the following :—

To M.D.S. 22 *Fd. Amb.*

11.30 *a.m.*

Please send up three field ambulances to evacuate my ADS as soon as possible. I am also getting rather short of dressings, especially wool and jaconet. I hear Slings has been killed and I propose sending Runners up to replace him.

G.

Even this is, however, a sorry effort. Let us consider some of its shortcomings.

(1) *Do not address Dressing Stations*; "22 Fd. Amb." means the main dressing station, and "A or B Companies" the advanced dressing stations.

(2) *Always use the twenty-four hour clock.*

(3) *Politeness costs nothing*, but it is as well to get out of the habit of saying "please," or you will find yourself putting it into telegrams and will get into serious trouble with Signals.

(4) *Make sure that you get the correct nomenclature for vehicles, equipment, etc.* To call an ambulance car a "field ambulance" is an error within my own experience. It seems unfortunate that in our official establishments there are things known as "motor ambulances." Logically, if a field ambulance is a medical unit in a field a motor ambulance should be a medical unit on motors. It must add to the confusion already existing in the mind of the layman if a vehicle and a unit are known by the same name, and some day (if it has not already happened) an ambulance will be ordered to a certain point and the sender of the order, expecting a motor vehicle, will be surprised to find a complete unit drawn up on parade. The use of the terms "motor ambulance cars" and "horsed ambulance wagons" would avoid such confusion.

(5) *Do not order transport as though you were ringing for a taxi.*

Your sole duty is to give your commanding officer information. It is for him to allot the transport. In this case, for instance, some of the wounded might utilize returning ration wagons and the cars thus saved might be sent elsewhere for badly-wounded men. Your O.C. must apportion the transport at his disposal, and to do this he wants not orders for cars but a clear idea of the situation in your dressing station.

(6) *Do not send vague indents for dressings but state your requirements exactly.*

(7) *No mention is made as to whether Lt. Runners has left or whether a relief for him is required.*

(8) *Always refer to people by their appointments and not by their names.* "Slings" may have been recently posted to the battalion and the fact may have been forgotten in the heat of the moment, or perhaps there may be a Sergeant of the same name in the ambulance.

(9) *Give the source of information*; it takes little longer to write "91 Inf Bde reports" than "I hear that."

(10) *No mention is made of the abdominal cases*; this information should be given as an indication of the urgency and is very much better than writing merely the word "urgent."

His next effort shows some signs of improvement and reads as follows :—

22 *Fd Amb*

9876/5432

1130 *Following require evacuation, lying* 6, 6 *sitting, abdominals* 2, 1 *extra Thomas splint required also* 5 *yds jaconet and* 8 *lbs wool.*

91*st Bde informs me that Lt Slings has been killed, have sent Runners in his place, Relief unnecessary.*

P. Green

1234/5678

This message is open to the following criticisms :—

(1) *The hour is in the wrong place.*

(2) *Full stops should be avoided* and AAA used instead, the importance of this is illustrated below.

(3) *Figures should always follow words.* A hurried reading of this message, especially if it has been written in copying pencil in the rain, might very easily lead one to interpret it as "lying 66" or "abdominals 21, extra Thomas splint required." Even if correctly read it is by no means clear whether "abdominals 2" have already been included in the "lying 6."

(4) *Always use correct abbreviations.* "91st Bde" should be "91 Inf Bde"; there may be an Artillery Brigade of the same number in the neighbourhood.

(5) *No attention has been paid to the necessity of writing certain words in block capitals.* These should be used for all proper names and for "key words." It is especially necessary in messages from medical officers because an All Wise Providence has, for some inscrutable reason, thought fit to

deprive ninety-nine per cent of medical men of the power of writing legibly. In this case, for example, "unnecessary" very easily becomes "necessary." No such misunderstanding could occur if "NOT necessary" had been written. Other examples of "key words" may be found in the use of the word "EACH" in such a message as "am sending 2 extra squads EACH to 2 Wilts and 1 Warwicks."

(6) You will notice that *three subjects are dealt with in one message.* Now the part about the evacuations will probably be needed by the transport officer, that about dressings and splints must go to medical store, the information regarding the relief will be filed in the office. How much better it would have been if three separate messages had been sent which could have been at once distributed to their appropriate departments.

(7) *There is nothing to tell the Field Ambulance Commander whether Brigade Headquarters knows that a relief has been sent to the Battalion.* For all he knows they may be screaming direct to the A.D.M.S. for a relief when Runners is already there. A copy of the message should be sent to these Headquarters for their information.

(8) *There is no "sender's number."* Always give a serial number to every message. If this is not done your C.O., in replying, must begin "with reference to your message regarding, etc., etc." Had it been given a number he would merely have quoted this in the space "in reply to" on the message form.

The war slowly drags to its end and, a week before hostilities cease, Green is for the last time confronted with the same situation.

At the cost of much confusion and unnecessary suffering on the part of the wounded he has at last learned the lesson he might easily have learned in peace, and he sits down and writes the following :—

MESSAGE 1.

To 22 *Fd Amb*
9876/5432
From A Coy
PG 21 5 *Nov*
Following for evacuation AAA lying 6 *includes abdominals* 2 *AAA sitting* 9
Time of origin 1130

P. Green

MESSAGE 2.

To 22 *Fd Amb*
From A Coy
PG 22 5 *Nov*
Send following by next convoy AAA Thomas splint complete 1 *AAA jaconet yds* 5 *AAA wool lbs* 8
Time of origin 1135

P. Green

MESSAGE 3.

To 22 *Fd Amb*—91 *Inf Bde*
PG 23 5 *Nov*
91 *Inf Bde BM* 234 *begins AAA MO Blanks killed* 1000 *AAA relief required at once AAA ends AAA Lt* RUNNERS *left at* 1030 *to report to* 1 *Blanks AAA relief* NOT *necessary AAA addsd* 22 *Fd Amb reptd* 91 *Inf Bde*
Time of origin 1140

P. Green

In conclusion perhaps I may just call your attention to a few practical points which have not so far arisen.

(1) Invariably keep a carbon copy of every message sent in your message pad, no matter how unimportant and trivial it may seem.

(2) Having written an order or message read it over to someone else and ask him to give you the meaning in his own words. It is incredibly easy to write something which is quite clear to yourself on which the recipient may put an entirely different interpretation.

(3) If, as in Message 3, you are sending out to more than one recipient, extra carbon copies must be made for each. At the end of the message write "addsd" before those whom it primarily concerns and "rptd" before those to whom it is sent merely for information. For example, if you are withdrawing your A.D.S.'s and want the A.D.M.S. to know, at the foot of your message you would write "Addsd A and B Coy rptd ADMS."

(4) Whenever you receive a message initial it at once and scribble the time of receipt upon it.

You will notice that in the suggested solutions the messages are written in telegraphic rather than narrative form. For routine medical messages this presents many advantages.

(1) The message form was used in at least 70 per cent of cases during war.

(2) It encourages brevity.

(3) Confusion and omissions are avoided as spaces are reserved for times, dates, etc.

(4) One copy may be sent by hand and another through Signals, if the message form is used universally the making of an additional draft is avoided.

(5) One message pad only is required for all purposes.

Now I am quite certain that many of you must be thinking all this a cumbersome and perhaps unnecessary procedure. I can imagine you thinking to yourselves, "How can I, as a qualified medical man, be expected to sit down, with perhaps wounded unattended to, and wrestle with a sort of bastard crossword puzzle such as you describe?"

I hope, however, that what I have said may do something to dispel this state of mind and to convince you that unless these things receive consideration unnecessary suffering may result. It cannot be a pleasant feeling

to stand surrounded by desperately wounded men and watch their chances of survival gradually diminishing owing to your own carelessness or ignorance.

We rightly pay very great attention to the training of our specialists, but it is well to remember sometimes that the responsibility for enabling our men to benefit from their services in good numbers, in good time, and in good condition rests largely with junior officers and with the N.C.O.'s and men of the Corps. In civil life it is little use having a magnificently equipped hospital with a brilliant staff if those responsible for sending in patients treat ruptured ectopics and perforated gastrics at home with castor oil and peppermint water. Similarly in war, the most brilliant operation performed at the base can never compensate for unnecessary suffering and loss of life owing to confusion and muddle in the forward areas.

It is inevitable and probably desirable that, in time of peace, we should tend to become a heterogeneous collection of workers taking as our standard those who occupy similar positions or appointments in civil life.

War will, however, bring about a complete reversal of all this and our civilian colleagues, perplexed and bewildered in the novel surroundings in which they find themselves, will look to us for guidance in such military questions as we have been considering this evening.

When that time comes we must be in a position to take the field as a team, every member of which is prepared to take such place as is allotted to him, realizing that our own personal ambitions and desires count as nought when compared with the efficiency of the Service to which we belong.

INFECTIONS OF THE HAND.[1]

BY W. H. OGILVIE, M.CH., F.R.C.S.

THE pathology and treatment of infections of the hand have now for some years been based upon the anatomical researches of Kanavel. Yet the textbooks available to students deal with this vital matter in the most inadequate manner, and it is still possible and usual for a man to qualify without knowing its essentials. I have taken as the subject of my lecture the more common infections of the hand. For a full and interesting discussion on the subject, I would refer readers to the small book written by the late L. R. Fifield of the London Hospital.

ANATOMY.

The skin of the hand is fine and hairy on the dorsum, thick, hairless, and marked by characteristic papillary ridges and creases on the flexor aspect. The subcutaneous tissue on the palm is scanty, and subdivided by dense meshes of connective tissue in a manner similar to that of the scalp; it is absent at the flexion creases in the palm and fingers, and here the skin is practically in contact with the deep fascia and the thecæ of the flexor tendons.

The skin and subcutaneous tissue over the terminal phalanx are modified in a special manner for a special purpose, and a knowledge of the anatomy of this phalanx is important in the surgery of infection (fig. 1).

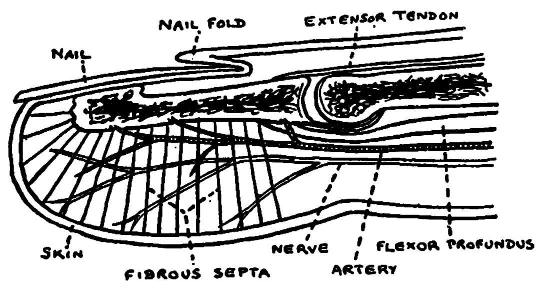


FIG. 1.—Schematic longitudinal section of terminal phalanx.

The nail is a cutaneous organ developed for protection and aggression, chiefly against the smaller enemies of mankind. It is limited at the sides by a shallow groove, and above it is overhung by a semicircular fold of skin, the cuticle or paronychium. The root of the nail extends about $\frac{1}{8}$ inch under the paronychium, and here the nail is formed by cornification

[1] A Clinical Lecture delivered at Guy's Hospital. Published by permission of the *Medical World.*

of the stratum lucidum of a specialized strip of epidermis. As the nail is formed it is pushed forwards, and appears on the surface, as yet unfinished; while cornification is incomplete, the nail is imperfectly translucent, and this immature nail is the opaque area known as the moon. The nail grows at the rate of 1/32nd to 1/25th of an inch a week, and as it advances over the nail bed its thickness is added to from below. There is no subcutaneous tissue under the nail bed, the deeper layers of the dermis being continuous

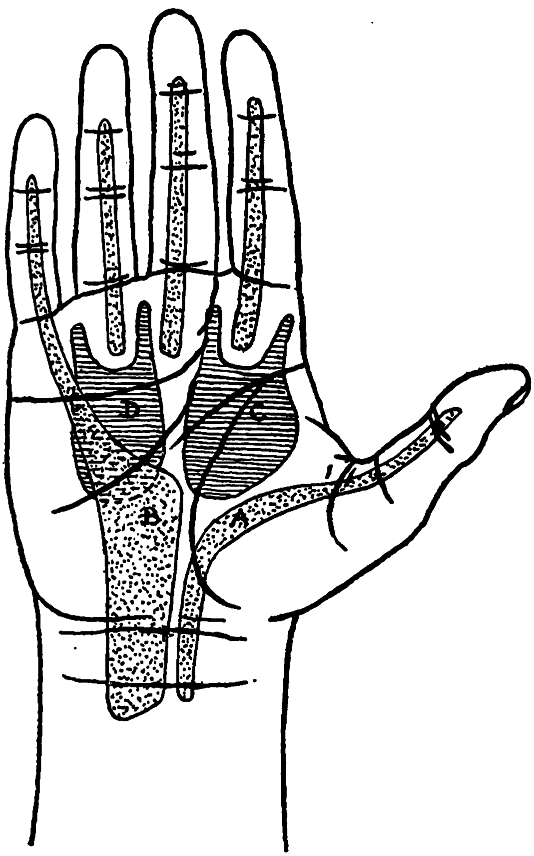


Fig. 2.—Synovial sheaths and cellular tissue spaces in the hand. A, radial bursa. B, ulnar bursa. C, thenar space. D, middle palmar space.

with the periosteum. On the flexor aspect of the distal phalanx, the finger pad, the subcutaneous tissue is very abundant, and is divided by a number of strong fibrous septa which radiate from the periosteum to the skin. The distal four-fifths is a closed space, containing loose fat, which therefore fluctuates. When an inflammatory exudation occurs in this space it cannot escape, and the tension rises rapidly, obstructing the blood-supply.

The lymphatic vessels of the hand and arm tend, as elsewhere, to follow

the veins. Thus the lymph channels from the fingers pass backwards to join others running on the dorsum of the hand. The arrangement on the palm is peculiar, for all the vessels are very fine, and they run towards the nearest part of the periphery of the palm to reach the dorsum of the hand; thus, the lower vessels run downwards, those in the middle towards the sides of the palm, those above, towards the wrist. The lymphatics from the ulnar side of the hand end in the supratrochlear gland, whence fresh channels run to the glands along the axillary vein. The lymphatics from the radial side of the hand run directly to the axillary glands. A few vessels from the outer side of the hand and arm accompany the cephalic vein, and end in the infraclavicular glands.

The fibrous sheaths of the long flexor tendons, the thecæ, extend from the base of the proximal to the base of the distal phalanges, being attached to the edge of their palmar surfaces. The sheaths are strong opposite the phalanges, weak opposite the joints, where they are closely related to the skin, and therefore exposed to injury. The thecæ of the fingers contain the flexor sublimis and profundus tendons, that of the thumb the flexor longus pollicis tendon. The synovial sheaths of the flexor tendons are disposed at the wrist in two sacs, the radial and ulnar bursæ (fig. 2). The radial bursa (A) contains the sheath of the flexor longus pollicis only; it extends into the forearm about 1½ inches above the anterior annular ligament, and downwards to the insertion of the tendon in the distal phalanx of the thumb. The ulnar bursa (B) is a large cavity containing the flexor sublimis and profundus tendons and the median nerve. This synovial sac consists of a common cavity to the ulnar side of the tendons, whence three pouches open towards its radial side, one in front of the tendons, one between the superficial and deep tendons, and one deep to the tendons. The ulnar bursa extends proximally 1½ inches above the anterior annular ligament, and distally sends a prolongation along the tendons of the little finger as far as the terminal phalanx, but ends as regards the other three tendons at the middle of the palm, just proximal to the superficial arterial arch. The radial and ulnar bursæ communicate at the wrist in nearly fifty per cent of cases. The thecæ of the index middle and ring fingers are lined by synovial sheaths which end proximally opposite the necks of the metacarpals.

Deep to the flexor tendons, and between these and the muscles which cover the metacarpus, are two cellular tissue spaces, known as the thenar space and the middle palmar space (figs. 2 and 3). These are only potential spaces, but, since they are liable to become infected by various routes, a knowledge of their site and anatomical relations is important. The thenar space (fig. 2 C) is bounded behind by the fascia covering the adductor muscles of the thumb, in front by the flexor tendons of the index and the first and second lumbricals and the thenar portion of the palmar fascia, to the outer side by the flexor longus pollicis tendon and the radial bursa, and to the inner side by a septum which divides it from the middle palmar

space, a sheet of connective tissue passing from the third metacarpal to the fascia behind the flexor tendons (fig. 3). The middle palmar space (fig. 2 D) is bounded behind by the fascia covering the interosseous muscles of the third and fourth interosseous spaces, in front by the long tendons to the middle, ring and little fingers, to the inner side by the hypothenar muscles, and to the outer side by the septum mentioned above (fig. 3). Distally, diverticulæ pass from these spaces along the lumbrical muscles (fig. 2). There is a third connective tissue space in the same plane which belongs to the wrist and not the hand, the space of Parona, which lies between the pronator quadratus behind, and the long flexor tendons in front.

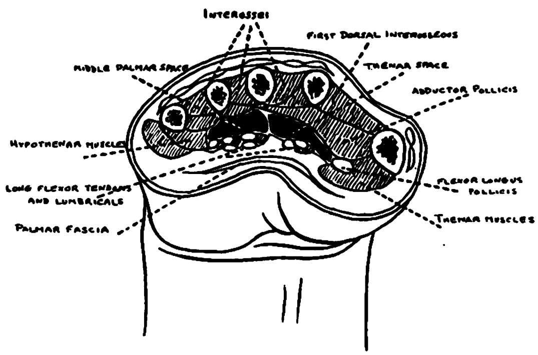


Fig. 3.—Transverse section across metacarpal region of right hand to show the cellular tissue spaces.

Infections of the Hand.

Lymphangitis.—Lymphangitis very commonly affects the hand because it is the organ of exploration and prehension, and is often pricked, scratched, or cut by septic objects. When such infections are acquired in the post-mortem room or the operating theatre, they are apt to be of a very virulent type and are not infrequently fatal.

In lymphangitis the site of the infection may be seen, or it may be too small to appear. The surrounding area is red, hot and swollen, and feels stiff and burning. The dorsum of the hand is œdematous. In the arm the lymphatic vessels are seen as red streaks, and the lymphatic glands to which they lead are enlarged and tender. When the infection has started in a finger, tenderness is diffuse, and not limited to one phalanx or to the line of the tendon sheath; movement of the finger within a moderate range does not increase the pain. In the hand the contour of the palm is not altered, the swelling being entirely on the dorsum. These observations enable us to distinguish a lymphangitis from an infection of the tendon sheaths or of the tissue spaces of the hand, an important distinction when treatment is considered.

Treatment of lymphangitis is never operative in the early stages. Rest is the first essential. The patient is put to bed, the hand splinted, and the

arm put in a sling. Hot fomentations or arm baths are applied frequently, and 20 to 50 cubic centimetres of polyvalent antistreptococcal serum are given subcutaneously, and given again if necessary on subsequent days. In a severe case 60 cubic centimetres of the serum, preferably 20 cubic centimetres of three different makes, may be given intravenously in a pint of saline solution. The local condition will subside and the general symptoms improve within forty-eight hours in the majority of cases. Abscesses may form at any part in the line of the lymphatic channels or in the glands, and require to be opened. Lymphangitis is said to be most dangerous when it starts on the outer side of the hand, because the infection may then travel directly to the axillary or even the sub- or supraclavicular glands without being arrested by intervening nodes.

Whitlows.—Infections of the fingers are commonly called whitlows, and of these four varieties are described: the subcuticular, the subcutaneous, the thecal and the subperiosteal (fig. 4). The first two are usually primary

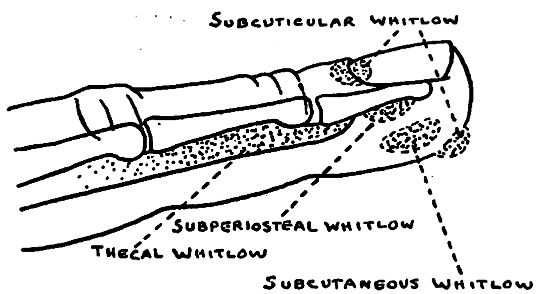


FIG. 4.

infections; the third and fourth varieties are rarely primary, but are due in most cases to extension from a subcutaneous whitlow.

Subcuticular whitlows are of two varieties:—

(1) *The purulent blister* is a superficial infection that may follow any trivial scratch, or may even arise where there is no visible injury.

Pus accumulates under the cuticle, forming a rounded yellow swelling. There is little pain and no constitutional symptoms. Treatment consists in snipping away the cuticle and applying antiseptic dressings. Should there be much pus or any swelling of the phalanx, a subcutaneous whitlow must be suspected, and the base of the blister examined for a small track leading to pus under the skin.

(2) *Paronychia.*—This form of subcuticular whitlow is much more important, because of its chronicity. The infection may enter through a fissure at the side of the nail, or be caused by a small injury in manicuring. It is a frequent cause of casualties among dressers, because daily scrubbing with strong antiseptics impairs the resistance of the skin, and the entry of pathogenic organisms from septic dressings is rendered easy.

Paronychia in its early stages is seen as a reddening and thickening of

the fold at the edge or the base of the nail; when the fold is pressed, a bead of pus appears between it and the nail. At this stage a wisp of gauze soaked in eusol or hypertonic saline should be pushed in between the thickened fold and the nail, and changed every few hours. If the hand is rested and this treatment pursued energetically, the infection will usually subside in a few days; otherwise pus gets under the nail itself, where free drainage is impossible. Exuberant granulations form between the nail and its bed, and cure is much more difficult.

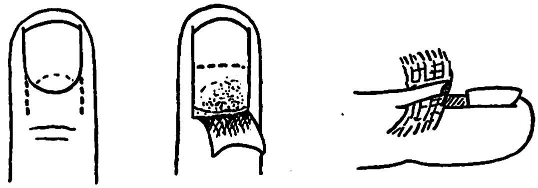


FIG. 5.—Treatment of paronychia. A, incisions outlining flap. B, flap turned back. Incision across nail. C, proximal half of nail removed. Gauze strip under skin flap.

It is usually possible to determine, by pressing on the nail, whether infection has spread to the nail bed. If this has occurred the nail feels wobbly, and pressure produces considerable pain and causes a bead of pus to appear at the root of the nail. An anæsthetic should now be given, and a band tied round the root of the finger to act as a tourniquet. Two parallel incisions are made upwards, starting at the sides of the nail and turning up the skin covering its base as a flap (fig. 5). The nail base is then inspected. If pus only extends under one side of the nail, that side is cut away. If, as in most cases, the whole nail base is undermined, the proximal half should be cut away, leaving the distal half as a protection, which will later be displaced by the growth of the new nail.

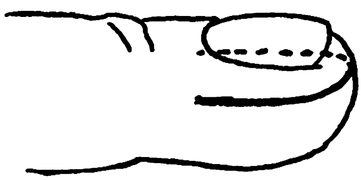


FIG. 6.—Incision for subcutaneous whitlow.

A subcutaneous whitlow is a cellulitis of the finger. It usually follows a prick and affects the pulp of the distal phalanx, which is red, hot, swollen and painful, throbbing with the pulse. The swelling is limited to the last joint, movements of the finger are not resented and there are no constitutional disturbances.

The terminal phalanx should always be opened by horseshoe-shaped incision, parallel to the nail, and just anterior to it (fig. 6). In mild cases

only one side of the horseshoe need be incised. This incision divides all the septa going from periosteum to skin, and therefore completely relieves the tension in the "closed space"; it passes behind the digital nerves; it cannot injure the tendon sheath or the periosteum, and it leaves a scar which is not on the site of pressure.

A *thecal whitlow* is commonly a sequel of a pulp infection. The pus reaches the tendon sheath by direct extension, by lymphatic spread, or by infection with the point of the knife when the obsolete mid-line incision has been employed to open a subcutaneous whitlow. The tendon sheaths may also be infected by the direct injury of a prick or scratch in the flexion crease of the fingers, where they lie close to the skin; by direct extension from a suppurative arthritis or in the palm from a tissue space abscess; or, rarely, by organisms carried by the blood-stream.

When a thecal whitlow is present, the patient looks and feels ill; his temperature and pulse are raised. The affected finger is swollen throughout its length, and held in the semiflexed position; active movements are very limited, and can only be carried out in the direction of flexion. The finger feels hot and may be a little reddened. Passive extension, and pressure along the line of the flexor tendons as far as the metacarpo-phalangeal joint, cause extreme pain. If the tendon sheath of the thumb or little finger is involved, extension of the infection to the radial bursa is probable.

Infections of the ulnar bursa show, in addition to the symptoms and signs of a thecal whitlow of the little finger, pain and tenderness over the anatomical site of the bursa in the palm and wrist. There is a very slight loss of concavity in the inner half of the palm and a more obvious swelling above the anterior annular ligament. The dorsum of the hand is œdematous. Voluntary movement of the index, middle and ring fingers is limited, and passive extension of these fingers causes pain, but to a less degree than in the case of the little finger. Infection of the radial bursa is shown by pain and tenderness over the palmar surface of the metacarpal bone of the thumb and the radial side of the wrist, with slight swelling of the thenar eminence; the other signs of whitlow, fixed flexion, loss of voluntary movements, pain on passive extension, and tenderness on pressure along the line of the fibrous sheath in front of the phalanges, are also present.

A thecal whitlow is one of the most serious emergencies that you may be required to treat in practice. Correct treatment undertaken immediately will ensure full restoration of function in a fair proportion of the cases; in the majority there will remain some adhesions of the tendons to their sheaths, so that the finger, though useful, has a limited range of movement. Delayed or faulty operation leaves at best a stiff, useless, and painful finger, which requires amputation later; more often it leads to wide infection of the sheaths and tissue spaces in the palm, so that the hand, after months of treatment and repeated drainage, remains a useless claw; at worst, and

by no means infrequently, it is responsible for the amputation of the limb or the death of the patient.

An incision in the mid-line of the palmar aspect of any part of any finger is evidence of the most gross and inexcusable incompetence on the part of the operator. The reasons why such an incision should never be made in the distal phalanx have already been given. In the proximal and middle phalanges, a mid-line incision also fails to relieve tension in the sub-

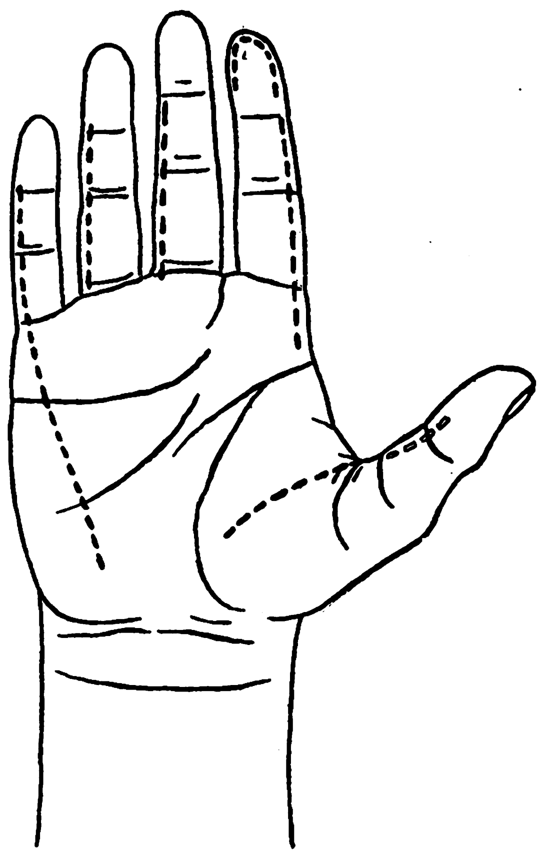


FIG. 7.—Incisions for draining pulp infections (shown on index finger), thecal whitlows, and abscesses of the synovial bursæ.

cutaneous layers, and leaves, after healing, a scar which limits movements, and is exposed to pressure. When the theca is opened by such an incision the tendons dislocate forwards, and lie exposed on the surface of the wound so that they must slough.

All incisions in the fingers should therefore be lateral. In the terminal phalanx, such lateral incisions may take the form of a horseshoe surrounding the pulp. In the other phalanges they may be made on either side, but an exposure on the ulnar side avoiding the lumbrical muscle is preferable,

except in the index, where an incision on the radial side has obvious advantages (fig. 7). The incision is just anterior to the digital nerve.

When dealing with a thecal whitlow a tourniquet should be applied before operation, since the degree of infection present and the amount of drainage necessary can only be estimated in a bloodless field. If the tendon sheath is seen to be distended, it is slit up along the side. In some cases of mild infection it may be sufficient to open the theca along the phalanges only, leaving it intact opposite the joint; in the majority the whole length of the sheath should be incised. When the ulnar bursa is infected, the theca of the little finger should first be opened on the ulnar side; a probe is then passed from the tendon sheath into the bursa, and the latter opened widely to the ulnar side of the flexor tendons. When the radial bursa is involved, the theca of the flexor longus pollicis should first be opened by an incision along its ulnar side, and the incision prolonged over the ulnar side of the thenar eminence, laying open the bursa as far as the annular ligament. In operations for drainage of the ulnar and radial bursæ, the deep branch of the ulnar and the muscular branch of the median nerve must be avoided at the upper end of the incision.

In order to obtain good function after suppuration in the tendon sheaths of the hand, it is essential that infection should be overcome before there is any destruction of tissue, and movements started before adhesions have formed. The exposure described provides the freest possible drainage, while the tendons remain in their sheaths and are protected from direct exposure by the anterior flap of skin, so that they do not slough. Drainage should be provided along the incision in the case of thecal infections, and into the retrotendinous pouch in the case of the ulnar bursa. This may be obtained by laying a Carrell tube along the wound and approximating the skin over it by two or three loosely tied stitches, after which two-hourly irrigation is instituted; or by placing a drain of rubber dam in position and putting the hand in a hypertonic bath every four hours. As soon as the general symptoms subside and the wound begins to look clean, the drain should be removed and voluntary movements of the fingers started. Fomentations will be required for a few days, after which they may be replaced by eusol dressings.

A sub-periosteal whitlow is usually the result of interference with the blood-supply to the terminal phalanx, following an infection in the closed space; this necrosis rarely affects the base of the phalanx, because this receives its blood-supply from the artery before it enters the closed space. Thecal whitlow and suppurative arthritis, which is itself usually secondary to a thecal whitlow, may lead to osteomyelitis of the phalanges.

Necrosis of the terminal phalanx should not occur if pulp infections are widely opened at an early stage by the horseshoe incision. Prolonged suppuration after drainage suggests bone disease, and the diagnosis is confirmed by the probe and X-ray. Usually all that is necessary is to remove a loose sequestrum representing the diaphysis of the phalanx, the

base and the joint being healthy. The final result of sequestrectomy is, however, apt to be unsatisfactory because the nail bed remains deformed, and disarticulation at the distal joint will be required after the sinus has healed. When a horseshoe incision has been employed, the palmar flap required to cover the end of the finger is healthy and unscarred.

Tissue Space Infections.

The middle palmar space may be infected directly by penetrating wounds of the palm, or indirectly, by extension from suppurating foci, especially from infected callosities over the metacarpal heads, and thecal whitlows of the middle and ring fingers. A collection of pus forming in the subcutaneous tissues under a callosity tends to pass backwards in the web between the digitations of the palmar fascia; a whitlow in the tendon sheath of the middle or ring fingers will ultimately rupture at the proximal closed end of the synovial pouch opposite the neck of the metacarpal; in each case infection reaches the middle palmar space along the lumbrical muscle. These isolated infections of the space are, however, uncommon. In those lamentable cases where the whole hand has become involved, following delayed or unsound treatment of a localized lesion, the palmar spaces take part in the general suppuration.

Where there is an abscess in the middle palmar space, the constitutional symptoms are usually severe. Locally there is marked swelling of the palm, whose normal concavity is converted to a moderate convexity. Œdema of the dorsum is also present.

Later, pus may track along the lumbrical muscles, and point in the webs between the middle, ring and little fingers. The characteristic points which serve to distinguish an infection of the middle palmar space from one of the ulnar bursa which it closely resembles are, that the bulging of the palm is much more marked and the swelling does not extend above the annular ligament, the pain and tenderness are less accurately localized, and the limitation of movements of the fingers is inconsiderable, while passive extension does not cause extreme pain.

Drainage of the middle palmar space is attained by making a longitudinal incision in the interval between the middle and ring fingers, extending from the free edge of the web to the distal transverse crease in the palm (fig. 8 A). This incision is deepened till the lumbrical muscle is exposed. A pair of Spencer Wells forceps is pushed along the dorsal surface of the lumbrical into the palmar space and opened widely; a glove drain is then inserted along its track.

The thenar space may be infected by punctured wounds, by extension from infected abrasions or subcutaneous whitlows on the thumb, or by rupture of a thecal whitlow in the index finger or an abscess in the radial bursa. Isolated infections of the thenar space are rather more commonly seen than those of the middle space. In late cases infection may spread from one space to the other by rupture of the intervening septum.

The clinical signs of an abscess in the thenar space are unmistakable. Because of the thinness of the radial expansion of the palmar fascia, swelling of the thenar eminence is very marked, the ball of the thumb becoming globular, red and hot; the web shares in this rotundity. Œdema of the dorsum of the hand is only moderate. The movements of the thumb are little limited unless the radial bursa is also involved.

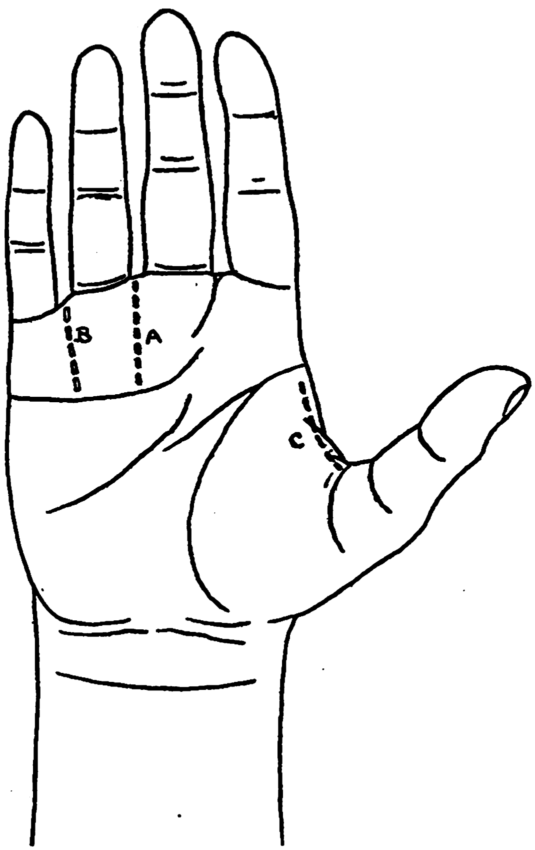


Fig. 8.—Incisions for draining the palmar spaces. A, middle palmar space. B, alternative incision for middle palmar space. C, thenar space.

The thenar space is drained by an incision just anterior to, and parallel with, the web between the thumb and the index (fig. 8 c). Where infection has followed a thecal whitlow of the index, the incision along the radial side of that finger is continued along the web. Spencer Wells forceps are thrust inwards along the anterior surface of the adductors of the thumb till the pus is evacuated. The opening should be made large, and a glove drain placed in position.

Discussion of Hand Infections.

A knowledge of the anatomy of the tendon sheaths, synovial bursæ, and tissue spaces in the hand is essential in order that their infections may be diagnosed accurately and treated effectively. But these infections are rarely primary. The most important of all primary lesions is a subcutaneous infection of the pulp of the terminal phalanx. Thecal and subperiosteal whitlows are, in the great majority of cases, secondary to such an infection; abscesses in the bursal sacs and tissue spaces are still later sequelæ. Correct and energetic treatment, if it be applied while infection is limited to the terminal phalanx will, in most cases, save the finger; if the sheath is

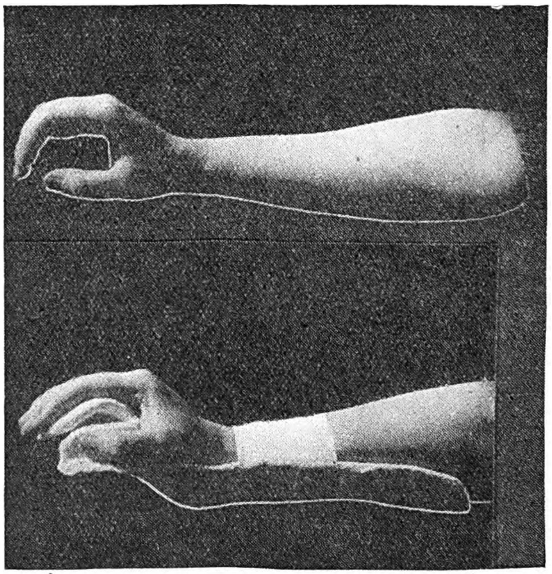


Fig. 9.—*Above*: Correct position for ankylosis of the hand.
Below: Moulded plaster splint applied.

infected it will save the hand, but will rarely restore the finger to full use; when pus has reached the palm, the freest drainage scientifically carried out is a desperate measure which may prevent infection of the bones and joints, but cannot avert some loss of function.

The neglected septic hand, a condition encountered too often even to-day, defies anatomical analysis; synovial bursæ and connective tissue spaces are alike involved in a widespread suppuration in which even the barriers of these compartments have been transgressed. Pus has found its way into all the spaces in the palm, and in the forearm has burst through the upper limits of the bursæ and spread widely in the space between the long tendons and the deep muscles. Here, all that we can do is to drain the tissue spaces and bursal sacs in the palm; to make a

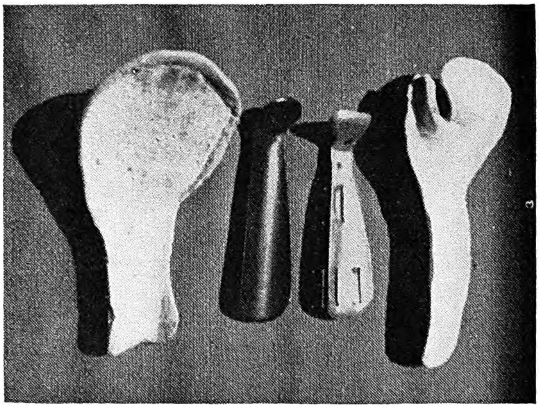
wide opening from side to side above the wrist and behind the long tendons, avoiding the vessels and nerves; to lay rubber drains in these cavities, and to persevere with splinting and frequent baths. Recovery, if it comes, will be slow and complicated by infection of the bones and joints of the carpus and metacarpus. The final result will be a hand that has lost most of its use.

When dealing with such a hand, which will almost certainly be stiff, it is important to realize that a small amount of movement may be very valuable in one position and almost valueless in another. Metacarpo-phalangeal joints with a range of movement of only 20° are useless when fully extended; if they are flexed to 45° the same amount of movement is most useful. At the inter-phalangeal joints, stiffness in either full extension or pronounced flexion is a serious handicap; if the stiff fingers are in a gradual curve, they can grasp large objects and be brought into opposition to the thumb. The optimum position for ankylosis of the hand is therefore one with the wrist dorsiflexed 45°, the thumb in full opposition, the metacarpo-phalangeal joints flexed 45°, and the fingers bent in the arc of a circle of about three inches in diameter (fig. 9). In this position, even though the long flexor tendons have sloughed or are anchored in their sheaths and the joints are fixed by a fibrous ankylosis, the hand is not useless. It can hold large objects or pick up small ones, and can wield pen or brush.

Shortly after the operation, while the drains are in position, and arm baths are being given every four hours, it is sufficient to keep the arm on a straight anterior splint with a ball of wool the size of a cricket ball lying in the hollow of the palm and fingers. As soon as less frequent dressings and diminished discharge allow it, a more permanent splint should be applied. The best form of splint to maintain any desired position of the hand is one made of plaster of Paris for the individual case (fig. 10 D). The hand is smeared with vaseline, and a freshly made slab of plaster is applied and smoothed into even contact with all its surfaces. As soon as the plaster has set, the slab is removed and the outline of the proposed splint drawn upon it with indelible ink pencil. If necessary, additional ribs of plaster bandage are applied on the surface of the slab away from the hand along the lines of stress, where the splint requires reinforcement. It is then trimmed to the marked lines with a sharp knife and set aside. When dry, the surface next to the hand is covered with a layer of lint fixed with flour paste. If soiling is anticipated, or permanence desired, the splint may be painted with white cellulose paint before the lint is applied. I have had splints so prepared in daily use for more than a year.

The most difficult cases of all to treat are those in which the fingers and thumb have been allowed to become stiff in a straight position. I must therefore warn you against two splints. The first is sometimes known as the long cock-up splint, an atrocious piece of apparatus shaped like a tennis racket (fig. 10 A). There is only one occasion in surgery when this

splint may legitimately be used, that is, for the first fortnight after an operation for transplantation of the flexors of the wrist into the extensors of the wrist and fingers. For all other purposes it is thoroughly vicious and cannot be too strongly condemned. The second is an ordinary straight splint applied from the elbow to the tips of the fingers. The board-like



A B C D

FIG. 10.—A, the cock-up atrocity. B and C, correct forms of cock-up. B is for either hand; C is for the right hand, and allows full opposition of the thumb. D, moulded plaster splint to hold hand in correct position for ankylosis.

hands which result from the use of these two splints were familiar objects in the plaster rooms of the military orthopædic hospitals at the end of the war. The dangers of the first can be avoided by destroying all such splints wherever they are found; the second danger is not so easily overcome, for it is the misapplication of a splint which has its legitimate uses.

SOME CONSIDERATIONS ON THE QUESTION OF RABBIT-ENCEPHALITIS IN RELATION TO POST-VACCINAL ENCEPHALITIS.

By H. M. WOODCOCK, D.Sc.

In the very interesting article by Major S. Smith, on the "Paralytic Accidents of Anti-Rabic Treatment," in the January number of the Journal, the author compares one of the particular conditions he describes with that of post-vaccinal encephalitis. He states that in the case of post-vaccinal encephalitis or encephalo-myelitis, it is only since the introduction of the method of preparation of the vaccine by means of "passage" through rabbits that any considerable series of cases has occurred. It may be worth while, therefore, to put forward a suggestion bearing upon this question.

It has been shown that in various localities, both in Europe and America, rabbits (and, incidentally, also other rodents, e.g., mice) are very liable to a naturally occurring pathological condition of encephalitis, or encephalo-myelitis, characterized by marked perivascular infiltration and the occurrence of the so-called "Encephalitozoon" bodies. In some cases, the rabbits appear quite normal; at other times, distinct epizootics occur. In the United States, Macartney found the condition in from forty to fifty per cent of apparently normal rabbits, and Goodpasture in about thirty per cent of stock animals bought from local dealers. Again, in Paris, Levaditi and his co-workers found the condition prevalent in rabbits purchased in the markets; and, further, Anigstein, working upon mice, found it to be very common in Warsaw. On the other hand, the spontaneous occurrence of this pathological condition appears to be just as rare in other localities (in more northern latitudes?). In the experience of workers in this country it has been rarely observed in the many apparently normal rabbits examined. Neither Da Fano nor Dibble found it; I, myself, with one apparent exception (to which reference is made below), have never found it; neither have I ever found it in mice. In Sweden, Kling did not observe it in 160 non-inoculated animals. Apparently, too, in Canada (Toronto) the condition is rarely to be found; at all events, it has not made itself noticeable.

Further, the proportion of rabbits showing this encephalitis, or encephalo-myelitis, has been found to be distinctly increased if the animals are suffering from some disease, or have been experimentally inoculated with a bacterial infection. Macartney found the percentage to be as high as seventy per cent in rabbits suffering from pneumonia or septicæmia, and even higher in those afflicted with snuffles. Similarly, Cowdry and Nicholson found the lesions present in about ten per cent only of normal mice, but in thirty per cent of animals used for experimental purposes. Again, Kling[1] was able to

[1] *Acta. Soc. Med. Suecanæ*, 52, 1926. [N.B. The references to all other work mentioned will be found in my previous analysis in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, July, 1925.]

inoculate successfully twenty per cent of rabbits with different strains of virus from cases of human encephalitis. The result was seen in the development, after several weeks, of a pathological condition similar to that above described; and in many cases he found also the characteristic "Encephalitozoon" bodies. Using rabbit-passage virus, kindly given me by Kling, I found the encephalitic lesions developed in twenty-eight per cent of the inoculated animals, and twenty-one per cent showed, in addition, the typical bodies. It must be borne in mind that the production of the bodies is a *sequel* to the cellular derangement; the "Encephalitozoon" is not the cause. In several cases, the occurrence of the lesions has been observed without the bodies having been found; though, in some instances, a subsequent re-examination of the particular material by other workers has revealed their presence. I have never found the bodies unless definite perivascular infiltration (and often cell-necrosis as well) was present. Kling also notes that where the histological changes appeared to be in an early stage, none of the bodies could be found; they occurred in the more advanced stages, when degenerate and necrotic foci were present. Kling regarded the bodies as reaction-products to an invisible microbe, which he compared with a chlamydozoan; but I think I have shown in a previous paper in this Journal that the general conception of the Chlamydozoa is as extinct as the dodo. In this connection, a very instructive case is that described by Cameron and Maitland, in their account of the observation of "Encephalitozoon" bodies in Toronto. Ten rabbits were inoculated from an acute case of human encephalitis, but apparently only one inoculation was successful. This animal died on the fifth day, but showed no gross lesions. From it, six others were inoculated and two of these had signs of nervous involvement and died on the ninth and tenth day, respectively. From the latter, a third passage was carried out and the series thus continued. The bodies were found first in the rabbit of the third passage and thence constantly in all the rabbits that died. The authors are inclined to think that the Encephalitozoon occurred as a spontaneous infection in the rabbit of the third passage and was subsequently transmitted. Bearing in mind, however, the observations of Kling and myself, together with the non-observation of the "natural" occurrence of the condition in Canada, in Sweden and in this country, I think it is much more likely that the production of the bodies was due to the inoculated human encephalitic virus.

From the above summary it seems most reasonable, I think, to conclude that an encephalitic condition in rabbits, corresponding to that occurring "naturally," and with which is associated the production of "Encephalitozoon" bodies, may also be induced by any of several causes, including virus-strains of human encephalitis. Now, the sole case in which I have, so far, found the lesions and the bodies in an apparently healthy animal, was in a rabbit which had been used by Professor Ledingham some weeks previously, in connection with his experimental work on vaccinia, but had

apparently quite recovered. My otherwise entirely negative results, after examining many normal animals, led me to consider the possibility of there being a definite connection between the vaccination of that particular rabbit and the subsequent encephalitic development; because that was the one known point in which the animal that gave a positive result differed from the others. Professor Ledingham kindly put at my disposal some more rabbits which had been similarly treated and had been no longer required since the conclusion of the experiments, in order that I might test this view. I had already cut sections from one brain and found a definite condition of perivascular infiltration, which was very suspicious, when I had to suspend work on account of illness. I had not then found any "E" bodies, but think it quite probable that, eventually, I should have done so had I been able to continue my work.

A brief comparison is necessary between the Encephalitozoon and certain other well-known bodies. An "Encephalitozoon" body consists of a clump or mass of densely packed little elements. Frequently, two or three such clumps may be found very close together; and they are often in a space which may have been originally occupied by a nerve-cell. The probability, indeed, is that they are formed in nerve-cells. Cowdry and Nicholson mention the frequent occurrence of a large, pycnotic nucleus at one side, and add that, from the size, relations and the presence of large, solitary nucleoli, it seemed clear that greatly distorted nerve-cells were concerned. Now, the individual little "Encephalitozoon" bodies strongly resemble certain minute forms of the Negri bodies occurring in rabies. So much is this the case that some workers have regarded the two as being different species of the same genus of a microsporidian parasite; this view is quite mistaken (*vide* Woodcock, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, July, 1925). The Negri bodies themselves are essentially similar in nature and mode of formation to the Guarnieri bodies of smallpox and vaccinia (though produced in different types of cell). That is to say, they are both, respectively, the diagnostic indication of a particular ectodermosis (Levaditi), or, as I prefer to regard it, ectodermic hæmatophagia; the difference being that the former is neurotropic, the latter dermotropic. There is, therefore, since these bodies are not specific living organisms, no *a priori* reason why the corresponding elements should not be produced in more than one type of cell by the same reaction, e.g., as Guarnieri-bodies in the vaccinia condition and as "Encephalitozoon" bodies in the encephalitic condition, *provided always* that the particular virus is able to come into close relation with each type of cell.

Now, the interesting and important point is this: Ledingham has found that the primary reaction in vaccinia is endothelial and vascular; that is to say, the condition starts as a mesodermic hæmatophagia, although the main development becomes ectodermic, or epithelial, subsequently. This remarkable fact, which is probably of far-reaching biological significance, shows that a hæmotophagia originating in cells belonging to one of the

chief embryonic layers may be capable of stimulating or inciting the cells of another layer to the same (or a corresponding) type of abnormal hæmatophagy. It is, to my mind, a further clear indication that the root-cause of these diseases is the derangement of one of the fundamental, normal cell-functions, that, namely, of blood-digestion.

And the histological findings suggest strongly that the encephalitis of rabbits, etc., is a comparable phenomenon. The primary reaction is most probably endothelial, the vascular endothelium and the neighbouring reticulo-endothelium being chiefly concerned in the more usual form of the condition.[1] But, in addition to causing an aggregation of endothelial (epithelioid), lymphocytic and perhaps neuroglial cells at various foci, the irritant stimulus spreads and affects certain nerve-cells in the vicinity causing these first to produce the "Encephalitozoon" bodies and subsequently to undergo necrosis. Thus, unlike the case of rabies and the Negri bodies, which undoubtedly represent primarily and solely a neurotropic disease, the nerve-cell involvement and the formation of "Encephalitozoon" bodies in the encephalo-myelitis of rabbits are secondary; just as is the cutaneous involvement and the production of Guarnieri bodies in smallpox and vaccinia. In support of this conclusion, mention may be made of the fact that, in the spontaneous type of rabbit-encephalitis, the kidneys may also be affected, "Encephalitozoon" bodies appearing in numbers in the renal cells, which subsequently undergo a considerable amount of necrosis and desquamation. Here, too, the involvement of the renal epithelium is most probably secondary to a vascular-endothelial disturbance, but in this case it becomes considerably more manifest. Kling does not mention, nor have I observed any renal derangement in animals successfully inoculated with his strains of human encephalitis virus; this point is corroborative of the view that the condition observed in rabbits so inoculated *is* due to a strain of human virus and not to that responsible for the naturally occurring encephalo-myelonephritis of rabbits. The above observations indicate, I think, that where an essentially ectodermic hæmatophagia is concerned, even though the endothelium may, as it were, convey and itself be affected by the ferment-virus, *only* epiblastic epithelial cells are eventually involved, whether a dermatropic or neurotropic derangement, or both result. On the other hand, where the abnormal hæmatophagia is essentially a meso-blastic one, as, for instance, one induced by a septicæmic toxin, or other cause, it would appear that *any* primary cell-type may happen also to become affected thereby.

I have previously suggested elsewhere (*British Medical Journal*, October

---

[1] In the Canadian type of Cameron and Maitland, the ependyma and meningeal endothelium seem to be primarily affected. Here, also, the bodies themselves are somewhat different in character and probably formed by a different, rather smaller type of nerve cell. This type of the bodies has never been observed in a spontaneously occurring case. It is interesting to note that Kling observed both types of the body in his inoculated animals, but I have so far found only the more common one in my material.

1, 1927), that a rabbit-encephalitis or encephalo-myelitis with production of "Encephalitozoon" bodies might be set up by one of several different viruses. And the history of the subject goes to support this view. The objection has been raised, however, that it is in the highest degree unlikely that so distinctive a phenomenon (as the formation of "Encephalitozoon" bodies) should be common both to an epizootic disease of rabbits and to transmitted human encephalitis. But that argument has been undoubtedly based on the erroneous idea that the "Encephalitozoon" is a living organism. It may be asked, however, Why is it that in human encephalitis, the only "bodies" so far observed have been Da Fano's minute granules? I think the answer is to be found in the pathological histology in the different cases. The condition in rabbits represents usually a more chronic and milder type. Often, indeed, when confined to the encephalo-myelon, it causes no manifest symptoms. Even when the animals were inoculated with Kling's virus from human cases, it was only after a couple of months or more that the above described histological conditions were found, and only rarely that manifest symptoms (e.g., paralysis) were noted. On the other hand the acute epidemic human type (encephalitis lethargica) shows a much more generalized inflammatory condition of the nervous system. There is a marked polymorphonuclear infiltration and the nerve-cells are considerably more stimulated by the virus. It is evident from Da Fano's account of the morbid histology that the cells take to cytophagy (his so-called neuronophagy) and ingest the polymorphs on a large scale. But they are unable to digest the latter successfully. The nerve-cells alter and break them down to a certain extent, before they themselves degenerate and die. The fine granules originate from the cytolysis of the polymorphs; I think this is clearly shown by Da Fano's figures. It may be that in the human nerve-cells, the normal blood-digestive function is too highly specialized and "resistant" for it to be deranged by any but a primary neurotropic ferment-virus, and that, instead, the cells react to the abnormal "mixed" (i.e., mesoblastic-neurotropic) hæmatophagia by attempting cytometaboly, probably an easier "throw-back." When the question is one essentially of a serious disturbance in one of the fundamental functions of cell-life, far greater variability in the manifestation of this may be expected, related as it must be to the varied biological history of different cell-types, than where the effects of a specific bacterial infection are concerned. Cameron and Maitland's case is interesting also from this point of view. It was only as the more slowly developing neurotropic derangement became intensified by "passage" that a rather more chronic type of condition resulted, "Encephalitozoon" bodies being found and the animals living until between the tenth and fifteenth days after inoculation, some of them indeed recovering. It will be seen that even then the condition developed more rapidly than in the case of the virus used by Kling and myself. This may stand in relation with the fact that the site of its manifestation was rather different, being chiefly restricted to the ependyma and meninges and that a different type of nerve-cell appeared to become involved.

Lastly, to sum up the bearing of these remarks upon my suggestion. If human encephalitis can be transmitted to rabbits, as certainly seems to be the case, it is by no means unlikely that a rabbit encephalitis can be transmitted to man, especially when the ferment-virus causes, in the first place, a mesodermic hæmatophagia, affecting the vascular and reticulo-endothelium. If, as I think will be the case, I am able to substantiate later, when able to resume my work at the Lister Institute, under the auspices of the Medical Research Council, the view that vaccination of rabbits may induce an encephalitic condition, with formation of "Encephalitozoon" bodies, which is otherwise not to be found commonly in local animals, the possibility of the addition of a dangerous factor will have to be taken into account. Because with the repeated "passage" the ferment virus of the vaccine, originally mainly dermotropic in nature, will tend to have added to it, in increasing degree, also a neurotropic element or quality. It may be noted in conclusion, that Major Smith himself gives the occurrence of a filterable neurotropic virus other than rabies, which is present in the rabbits, as one of the theories of the causation of the encephalitic accidents of anti-rabic treatment by means of leporine vaccine, which, he considers, has much to recommend it. At any rate, in the light of what has been said above, I think that my theory has much more in its favour than the one put forward of a dormant or latent virus or microbe, already present in the individual whose activities are "fanned into flames" by the vaccination.

THE EVOLUTION OF THE NEW PHYSICAL TRAINING TABLES.

By Major T. F. KENNEDY, O.B.E.,
Royal Army Medical Corps.

In this age of mechanization the use of our muscles becomes less and less needed as a means of locomotion, and so physical training becomes more and more important if we are to keep our systems toned up and our bodies fit. I will therefore recount briefly its history from the earliest time, as perhaps it may be of interest to trace the various steps throughout the ages which have led up to the modern conception of physical training.

Physical exercises, as a factor for education and development, are not a modern idea—nor a product of our day—we find them known and used as far back as the history of mankind relates.

China, which is one of the oldest civilizations of which we have any knowledge, possessed two systems of exercises, one which served as a training for war, and one for use in the healing of disease, in fact a kind of remedial exercise. In the oldest histories of the Japanese, Jews, Indians and Persians, physical exercises are mentioned, and in pictures from Egypt we get illustrations of the type of exercises used there in the very early days.

Among none of the people of olden time did physical exercises reach such a height of development as amongst the Greeks. In all that concerns development of the body the ancient Greeks still stand as an unattained model for all nations. From Greek we have derived the term gymnastics which, translated literally, means "the naked art," the explanation being that under certain conditions they performed the exercises naked. The Greeks summed up the factors for education in two words—music and gymnastics—so they could not express more strongly the importance they attached to physical exercise. By music they understood some of the more important means used at that time for education of the mind, especially the recitation of poetry with accompaniment. By gymnastics they understood the means for that development which was gained through physical exercises. The Greeks understood the close connection between the mental and physical side of men, and had learned that during the development of such physical qualities as health, strength and control over the body, there must be a strong effect on the mental qualities of will, energy and courage, self-reliance and control. The educational influence that gymnastics exercised upon the Greek people is most distinctly seen in their sculpture, which is accepted as some of the most beautiful in the world.

The Olympic Games were the best known of the contests for the advancement of physical exercises, and were held every fourth year for a period of some 1,200 years, as we have a record of them from 776 B.C. to A.D. 393, when hey were forbidden by the Christian Emperor of Rome,

Theodosius. It was only when the decadence of the Greek people set in that gymnastics lost their significance and degenerated. Professionalism stole in, and the majority of the population then preferred to watch the contests of professional athletes rather than participate themselves.

In the Roman Empire also games and exercises held a prominent place, but they never attained that prominent national position which they did amongst the Greeks. Again, in the Roman period professionalism in the shape of Gladiators was contemporaneous with the decline of the Empire.

With the introduction of Christianity all interest in physical exercises disappeared for a long time. The early Christians preached asceticism as a counter to the sensualism which surrounded them ; to them the spiritual was everything, the physical had to be subdued.

Throughout the Middle Ages the Knights were the only class to cultivate physical exercises, probably because they, as warriors, stood especially in need of physical strength.

Towards the end of the eighteenth century, we find evidence of systems beginning on the Continent, particularly in Germany, Denmark and Sweden, and it is from these beginnings that the modern systems of physical training have evolved.

Until the beginning of the nineteenth century it was not realized that in order to give instruction in the development of the human body it is essential to have a working knowledge of anatomy and physiology. The name of Ling is associated with this big step, and it is to him we are indebted for the fact that our modern systems are on sound anatomical and physiological lines.

In 1860 an Army class consisting of Major Hammersley of the 14th Foot, and twelve N.C.O.s was formed at Oxford to learn gymnastics under the superintendence of Archibald McLaren, and this class later developed into the Army Gymnastic Staff. The exercises taught aimed at developing muscular strength by work on the horizontal and parallel bars, on the trapeze and with heavy dumb-bells. They were very localized in their effect, with the result that there was over-development of some groups of muscles, with neglect of many others. There was tremendous development of the chest and upper extremities, without any proportionate development of the trunk and legs. These gymnastics continued until 1889 when Captain Fox introduced physical drill without arms.

In 1890 Captain Fox paid a visit to Sweden, where he was so impressed with the Swedish (Ling's) system, that he persuaded the Army Authorities to adopt it partially, but there was still a lot of the old gymnastics retained.

In 1904 a Swedish instructor was attached to the gymnasium at Aldershot to give instruction in the Swedish methods, but it was not until two years later—1906—that physical training on the Swedish principle was definitely adopted by the Army, and the Army Gymnastic Staff became the Army Physical Training Staff. The principle of the Swedish system is

the developmeut of the body as a whole, so that all parts derive benefit from the training, and not merely one or two groups of muscles. A Manual of Physical Training was printed in 1908, reprinted in 1914, and has held sway up to 1929, when the present physical training tables were adopted. A new manual is now in the hands of the printers.

The new tables were adopted after an extended trial at the Army School of Physical Training, Aldershot. Three comparative squads were taken, one doing the old tables, which were practically Ling's, the second doing the Danish exercises (Neils-Bukh's), and the third doing the new tables, which are a mixture of the Swedish and Danish methods with our own order and also our own horse and ground work. Ling's exercises were found to be too static, they lacked rhythm, did not induce sufficient interest, pleasure or enthusiasm in the class, and in many exercises a considerable number of the squad remained idle, so that the amount of work done, for the time taken, was not enough. Niels Bukh's, on the other hand, showed plenty of movement, they were rhythmical, they were more strenuous, and no time was wasted, but stretching exercises played too large a part in them. The new tables are devised to embody the virtues of both the others, without the drawbacks of either, they are largely based on the Swedish exercises, but sufficient of the Danish tables are embodied to give the movement, rhythm, interest and pleasure required. The strenuous stretching exercises of the Danish system were not embodied.

It was found as a result of these trials that the best results were obtained by the squad doing the new tables. The main principle aimed at in the tables is the harmonious development of mind and body, in which rhythm, co-ordination and self-effort take their part. This is obtained by a series of recruits' tables, 1 to 8, in which the recruit is gradually worked from one table to another, roughly averaging three to four weeks on each. The transition from one table to another is always worked gradually, taking in one or two exercises from the new and dropping one or two from the old, and so on, until the class has moved on to the new. Recruits seldom get beyond Table V in their 100 attendances.

For trained soldiers there are two separate tables, the aim of which is to keep in good physical condition those who have already been built up by the recruits' training.

Each table represents a daily lesson occupying between fifty and sixty minutes.

We can thus see that the building up of our modern conception of physical training has been a tedious matter, progressing through the ages, progress being sometimes fast and sometimes slow according to the necessity at the particular period for physical exercises, but one can say that it has not been evolved one moment too soon for never was physical training more needed than it is at the present day.

REFERENCES.

A Textbook of Gymnastics. By K. A. Knudsen.
Manual of Physical Training.

Editorial.

REPORT ON THE HEALTH OF THE ARMY FOR THE YEAR 1929.

In submitting this report to the Under Secretary of State for War the Director-General, Army Medical Services, states that although the exceedingly low incidence of sickness noted for the year 1928 has not been maintained, the health of the Army during 1929, both at home and abroad, was very satisfactory.

The rise in the admission rate was mainly due to an epidemic of influenza which occurred during January, February and March, 1929. A similar epidemic occurred among the civil community which is stated to have been the worst, with the exception of the pandemic of 1918-19, since the disease reappeared in this country in 1890.

The admission ratio of soldiers was 468·5 per 1,000 of the strength, compared with 426·2 in 1928 and 456·1 for the period 1924-28. The principal causes of admission to hospital were malaria, inflammation of tonsils, venereal diseases and inflammation of areolar tissue, in the order mentioned.

The admission ratio per 1,000 of strength of influenza rose from 8·8 in 1928 to 36·8 in 1929, and that of malaria from 35·7 to 41·2. There was a slight decrease in the admission ratio for diseases of areolar tissue, gonorrhœa and soft chancre. There were 438 deaths, or 2·45 per 1,000 of strength, compared with 2·38 per 1,000 in 1928, and 2·46 for the period 1924-28.

The commands with the highest ratio of inefficiency from sickness were: Iraq, Aden, South China, Shanghai, Jamaica and Gibraltar. Malta, the Rhine and Bermuda had the lowest ratio of inefficiency.

The number of invalids discharged from the Army during the year was 1,808, or 10·10 per 1,000 of strength, compared with 9·06 in 1928, and 11·08 for the period 1924-28. The principal causes of invaliding were inflammation of the middle ear and tuberculosis. There was an increase in the number of cases of suppuration of the middle ear and a diminution of the ordinary cases of inflammation compared with 1928. The tuberculosis was mainly pulmonary. The principal causes of inefficiency on account of sickness in hospital were gonorrhœa, inflammation of areolar tissue, fractures, influenza, malaria, and inflammation of tonsils.

The average sick time to each soldier was 9·33 days, and the average duration of each case of sickness 20·35 days.

The combined ratio of constantly sick in hospital and under treatment as out-patients was 41·43 per 1,000 of the strength, compared with 38·98 in 1928, and 42·79 in 1927, and 40·34 for the period 1924-28.

In the notes on diseases attention is drawn to two charts showing the monthly incidence of the most prevalent diseases at home and abroad, except India, for the last two years. Chart III illustrates the common diseases at home; these are influenza, diseases of bronchi, tonsillitis, the digestive system, venereal diseases and areolar tissue. Local injuries are also shown. The marked rise in the number of cases of influenza in January, February and March, 1929, is shown, also a rise in the number of cases of tonsillitis during the same months during both 1928 and 1929; but in 1928 the greatest number of cases occurred in February, whilst in 1929 they occurred in March, just before the rapid decrease in the number of cases of influenza which followed in March. Some of the later cases of tonsillitis may have been associated with the outbreak of influenza, but there is no evident relation between the two diseases in the early stages of the outbreak. In the autumn months there is a slight increase in the number of cases of tonsillitis with a distinct remission in the first fortnight of December, which is apparent in both years, but followed by a rise at the end of the month. During the summer months the curves show a decrease in all the diseases except the digestive system, which shows a slight rise in July in both years.

A good deal of research work has been carried out in recent years on the micro-organisms present in affections of the throat, but so far it has not been possible to base any successful preventive measures for tonsillitis on the bacteriological results obtained. Tonsillitis is probably a saliva-borne disease in many cases, and in view of the results obtained in America on the control of this form of infection by washing table equipment in boiling water, it would be interesting to see if this simple procedure would have any effect in diminishing the prevalence of tonsillitis in our barracks.

The number of men constantly in hospital for the more common diseases was 1,038 in 1928, and 1,193 in 1929. The number of working days lost to the Army at home on account of these diseases was 379,934 in 1928, and 435,729 in 1929.

Abroad, excluding India, the most prevalent diseases were venereal diseases, which caused the loss of 104,335 working days, local injuries, diseases of the digestive system (except tonsillitis and diseases of the liver), tonsillitis and sandfly fever. The total working days lost from all the diseases were 186,602, and of these it will be noticed that venereal diseases caused more than one-half.

There was an increase in the number of admissions for diphtheria in 1929, but the incidence was considerably lower than in 1927. A small outbreak occurred at Woolwich in the 2nd Training Battery, Royal Artillery, in the middle of November. In all, 9 cases of diphtheria and 14 carriers were found. The personnel were subjected to the Schick test and 225 men (37·5 per cent) were found to be positive. Active immunization with diphtheria toxoid-antitoxin was carried out and no further cases occurred. In Egypt there were 42 cases as against 23 in 1928. Over

80 per cent of the cases occurred in Cairo. It is difficult to account for the increase in the disease among the troops in Egypt; the cases were widely distributed as regards units and seasons. It appears that there has been a corresponding increase among the civil population.

There has been a slight increase in the number of admissions for dysentery, which is probably due to an improvement in diagnosis. Of the total admissions, 454 were classified as bacillary and 250 as amœbic, while 462 were unclassified. In India there were 1,030 cases, compared with 876 in 1928. Of the cases, 211 were protozoal, 388 bacillary, and 440 clinical dysentery. The proportion is much the same as in the three previous years. In view of the facilities now available, it was hoped that a larger proportion of cases would have been definitely diagnosed. It is considered that the figures do not represent the true state of affairs. Where care is taken to send a suitable specimen from a patient as soon as he is admitted to hospital, a bacillary exudate is seen in eighty per cent of the cases. In the experience of workers in the military laboratories, the exudate seen microscopically in acute bacillary dysentery is for practical purposes absolutely diagnostic of this condition. It is considered that the protozoal exudate described by certain authors in the past is rarely seen in the ordinary amœbic infection, the usual finding being a few epithelial cells, lymphocytes, an occasional leucocyte, red blood-corpuscles and *E. histolytica.* A similar nondescript exudate is said to be found in the convalescent stages of acute mild bacillary infection, though clumps of leucocytes and ghost cells can usually be found if search is made for them. The term indefinite exudate is now used in all military laboratories in India to describe an exudate in which neither *E. histolytica* nor a typical bacillary exudate has been seen.

If such an exudate is found, further specimens are ordered to be sent, and if these are still negative the case is to be examined during convalescence for *E. histolytica* cysts.

In India, the term clinical dysentery is now employed for all cases in which neither the causative bacillus, nor *E. histolytica* or its cysts, has been discovered, and therefore includes typical bacillary exudates as well as indefinite exudates.

The *B. dysenteriæ* (Schmitz) was isolated from 111 cases of dysentery in 1929. It is stated that many of the bacilli when isolated were agglutinated only in a low dilution of a high-titre serum prepared from a standard strain. A serum prepared with one of these strains agglutinated all the others in a dilution of only 1-250, though it readily agglutinated a standard strain when diluted 1-1,000.

The total number of cases of dysentery and diarrhœa in which dysentery bacilli were isolated was classified as follows :—

B. dysenteriæ	(Flexner)	1,228 cases
,,	(Shiga)	220 ,,
,,	(Sonne)	47 ,,
,,	(Schmitz)	137 ,,

It is possible that with the urge to diagnose bacillary dysentery some cases of the amœbic type might be missed. Some amœbic cases might be hidden among the indefinite exudates from which dysentery bacilli have not been isolated. But if these cases are examined during convalescence according to Regulations, *E. histolytica* cysts should be detected in amœbic cases which have only received a few doses of saline during the acute stage. Forty-three such cases are reported in 1929, in which *E. histolytica* cysts were detected during convalescence. If many amœbic cases had been missed and left untreated, the incidence of hepatitis and tropical abscess should be increased, but in 1929 there were twenty cases less than in 1928.

The histories of 94 cases of hepatitis and liver abscess were examined; 74 were amœbic in origin, but fifty per cent of these gave no history of dysentery or diarrhœa. A severe case of dysentery was found to be due to *B. gaertner*, and the patient made a rapid recovery after the administration of an autogenous vaccine of the bacillus.

There were 265 admissions for enteric fever for the whole Army, compared with 239 in 1928. Of the total admissions, 106 were typhoid fever, 23 paratyphoid A fever, and 121 enteric group. The large proportion of cases remaining unclassified is stated to be due to the reduced value of the agglutination test in inoculated soldiers as a means of differentiating between the four organisms of the group. This difficulty is now well recognized, and in the Editorial on the State of the Public Health we drew attention to the suggestion of the Ministry of Health that a strain of the typhoid bacillus free from flagella, such as the standard type O 901, should be used for the agglutination test, on the ground that the somatic agglutinin is absent in the so-called anamnestic rise of agglutination titre observed in inoculated persons, or former enteric cases who become the subject of non-enteric infection. Major Whitehead, however, has found that O agglutinins may be present in significant amount in inoculated soldiers who have never suffered from typhoid fever. The whole question obviously requires further investigation, and we are glad to observe that in India the sera from bacteriologically proven typhoid, paratyphoid, "enteric group" infections and pyrexia definitely non-enteric in origin, are being tested with O and H emulsions. Interesting results are stated to have been obtained, but the tests are being continued during 1930-31, so that a large number may be available for comparison.

In India there was a rise in the number of admissions for typhoid fever in 1929, the figures for British troops being 57 in 1928, and 102 in 1929, and for Indian troops 170 and 191. It is thought that this increase is mainly due to careful laboratory work in the diagnosis of cases of pyrexia without any obvious signs. The importance of an early diagnosis in mild cases of dysentery and diarrhœa is being realized by the troops and families, and many cases, both British and Indian, now report sick who in former days were never seen by a medical officer.

A clinical classification of typhoid fever cases into severe, moderate and

mild, according to the duration of the pyrexia, showed a remarkable percentage of cases among British troops with a short pyrexia of eleven days or under. This was not so marked among Indian troops, and it is believed that many cases of bronchitis, pneumonia, etc., are in reality typhoid fever.

Taking into account the extreme mildness of certain cases among British troops, it seems likely that cases of abortive typhoid fever are also overlooked. Such missed cases by acting as temporary carriers may cause the sporadic occurrence of small numbers of cases in a unit. Two examples of these mild cases are quoted. In one of these there was a rise of temperature for about twenty-four hours, after which the patient was discharged to duty; he was readmitted twelve days later with fever which only lasted forty-eight hours, and a blood-culture was taken at this time. Four days later the man was discharged to duty feeling quite well, but the blood-culture proving positive he was readmitted to hospital and sent to the enteric depot at Kasauli.

The second case was a British soldier who had vague abdominal symptoms, a slightly enlarged liver, but no fever. He gave a history of fever for two days before admission to hospital. *B. typhosus* was isolated from his stools.

Four similar cases are reported amongst Indian troops, in whom the pyrexia was not more than three or four days. Two of the cases were recalled from duty to hospital on receipt of the report on the blood-cultures.

Ambulant cases among Indian troops are stated to be a source of danger. Among the deaths in this group there were six cases who died of toxæmia, perforation, etc., shortly after admission to hospital.

Most of the cases of typhoid fever were diagnosed by blood-culture. It must be remembered that a case is not allowed to be diagnosed typhoid fever until the *B. typhosus* has been isolated from blood, stools, or urine. It is important to take the blood-culture before the eighth day, but if early culture has been omitted, it is worth taking cultures late in the disease. In forty-two Indian cases positive blood-cultures were obtained after the eighth day, and from one case even as late as the twenty-eighth day of pyrexia.

Most of the typhoid cases in both British and Indian troops were sporadic in character. Various small outbreaks of three or four cases occurred during the year. At Nowshera there were twenty-four cases in a British field battery; the outbreak was attributed to water infected by an ambulatory case from whom the *B. typhosus* was isolated.

The number of cases diagnosed paratyphoid A among British troops is increasing year by year. Among ninety-four cases of "enteric group" infection, 20·2 per cent classed by the Widal reaction would be considered as paratyphoid A. The incidence of paratyphoid A among Indian troops is much the same as among British troops.

There were no cases of paratyphoid B in British troops, but eight cases were diagnosed bacteriologically among Indian troops. These were milder than the typhoid and paratyphoid A cases.

There were thirteen cases of paratyphoid C in Indian troops, but none among British troops. Eight cases occurred in Kohat, five in one unit. In all cases the bacillus was isolated from the blood, and in one case it was also isolated from the stools. The cases were discovered in different parts of India, and in some of them the pyrexia was only ninety-six hours in duration.

A number of bacilli resembling the *B. fæcalis alkaligenes* have been isolated in blood-cultures from cases of continued fever in both British and Indian troops. In two cases the agglutinins developed to a high titre, 1-1,000.

The inoculation state of British troops in India showed that 90·2 per cent of the officers, and 96·1 of other ranks, were protected.

There was a widespread outbreak of influenza among troops at home during 1929. The admission rate was 36·8 per 1,000 in 1929, compared with 8·8 in 1928. The epidemic was most severe in the Eastern Command, where the admission rate reached the high figure of 93·2 per 1,000. The cases were of a moderately severe type, but the death-rate was only 0·03 per cent. Of the fatal cases a number showed the heliotrope facies so common in the outbreak during the Great War.

The reduction in the incidence of malaria last year was not maintained, owing to an increase of 1,312 cases in India. Mauritius showed the highest incidence, 187·6 per 1,000, then came S. China with 99·0 per 1,000, and India with 91·3 per 1000. In Egypt there were only 39·4 cases per 1,000, and the decrease was general throughout the country. The reduction in the Sudan from 364 to 131 cases is partly attributed to the evacuation of El Obeid. It is stated that the increased admission rate for malaria in India was almost entirely due to the outbreak of malignant tertian malaria in the N.W. Frontier Province and Northern Punjab. In spite of this the year's results are considered to be better than any year, except 1928, since the Great War. Two drugs are under trial in India, plasmoquine and lupinquina. Only a few cases were treated with the latter drug, as the patients relapsed readily. Plasmoquine was tried in three series of B.T. cases. The toxic symptoms noticed were methæmoglobinæmia, abdominal pains and cyanosis. These symptoms were more frequent among the patients treated as out-patients. An analysis by Major Manifold of the results obtained will be published in an early number of the Journal.

The incidence and deaths from pneumonia in the Army remain very constant and, in spite of the various lines of treatment advocated, the mortality shows no reduction when large numbers of cases are considered. The case mortality in 1929 for 604 cases was 10·4 per cent, and for the period 1924-28 for 3,056 cases it was also 10·4 per cent.

The cases of undiagnosed fever, pyrexia of uncertain origin, amounted to 111 in 1929, a few less than in 1928. It is stated that this group of fevers must be considered in association with others, more especially dengue and sand-fly fever, for on studying the reports of cases it is evident that the diagnosis in the latter groups was not completely established, and that it

would have been more scientific in these cases to admit that the cause of the pyrexia was uncertain. In India, where at one time it was considered almost discreditable to use the term pyrexia of uncertain origin, an order has recently been issued that such a diagnosis may be made, provided the case cannot be identified with any recognized disease. A special case sheet has been introduced which when completed is scrutinized by a district committee, including the pathologist and medical specialist. If passed by the committee, the case sheets are forwarded to Army Headquarters for analysis and classification.

There has been an increase in the incidence of sand-fly fever for the Army as a whole, due to the greater number of admissions in India. In Malta the ratio per 1,000 fell from 116·6 in 1928 to 46·3 in 1929, and in Egypt from 38 to 25. It has already been pointed out that the diagnosis of sand-fly fever is often erroneous, the preliminary short continued fever of benign tertian malaria being often diagnosed as sand-fly fever. It has been noted as a not uncommon experience that a person suffering from malarial paroxysms has had a previous admission for sand-fly fever. In Malta, where the diagnosis of sand-fly fever is less open to question, it is comparatively rare for a man to have a re-infection with sand-fly fever; out of 119 admitted for the disease in 1928 only 3 had a re-infection in 1929. But in one station in India it is recorded that of those admitted for sand-fly fever in 1929, some twenty per cent had been admitted in 1928 for the same disease.

The admissions for pulmonary tuberculosis gave a ratio of 1·2 per 1,000, and for other than pulmonary 0·5 per 1,000. The ratio for pulmonary tuberculosis for the period 1924-28 was 1·2 per 1,000.

In accordance with the recommendations of the Joint Medical Services Committee, records are being kept of the incidence of pulmonary tuberculosis as influenced by branch of the service, age, length of service, service overseas, tropical and other diseases, etc. The figures for a full year are not yet available, but an analysis of the figures received brings out a very high incidence in the Foot Guards, a point to which attention was drawn many years ago.

Tonsillitis, to which we have so often drawn attention in previous Editorials, appears to be slightly increasing, the ratio per 1,000 in 1929 being 37·9, compared with 33·3 in 1928, and 22·7 in the last complete pre-war year. The outbreak of influenza in the Eastern Command in 1928 did not affect the admissions for tonsillitis. Climate does not seem to have much influence on the disease, the admission rate in Scotland and the North of Ireland was less by thirty and twenty-three per cent respectively than at Aldershot, one of the driest parts of England. The increase in the number of admissions for tonsillitis is thought to be accounted for by the changed mentality of the soldier. Many men are considered now to report sick for minor ailments, such as sore throats, which in former days would have been treated in the barrack room *secundum artem*, so as not to give the regiment a bad name.

If tonsillitis had been mainly spread by droplet infection in the barrack room, as was at one time thought to be the case, the improved accommodation and diminution of overcrowding since the war should have produced some effect in diminishing the number of admissions. This has not been the case, and it remains to be seen whether contaminated mess kits are the villains of the piece, as the experiments made in America seem to suggest.

Admissions for diseases of the digestive system, other than tonsillitis and diseases of the liver, are somewhat higher than in 1928. The report states that "the effects of treatment of gastric and duodenal ulcers, unsatisfactory in civil life, are even more so from a service point of view. The proportion of admissions from relapse, gastric ulcer, 23·9 per cent, and duodenal ulcer, 15·6 per cent, is disheartening, and it is doubtful if a man who has suffered from a gastric or duodenal ulcer is really fit to undergo the strenuous conditions of service life."

We are very glad to note the low mortality following operations for appendicitis. In military hospitals (excluding India) 934 operations were performed, 805 for acute and 129 for chronic appendicitis. The total mortality was 0·62 per cent.

Part II of the Director-General's report is devoted to the Special Departments. In the medical section there are some interesting notes on diseases of the digestive system. The difficulty of diagnosing between chronic appendicitis, cholecystitis and duodenal ulcer is simplified by the patient's reaction to alkaline treatment. Pain in gastric and duodenal ulcer generally disappears after three or four days of the Hurst treatment. If pain continues after seven days from the commencement of alkalies, it may be taken that the condition is not solely due to duodenal or gastric ulcer. In elderly people alkalies must be given with caution, as intensive treatment has been known to cause auricular fibrillation.

A number of cases of cysticercosis has been studied, and this condition should be considered as a possible cause of epilepsy commencing in adult life, especially during or after service in the tropics. Occasionally man becomes the intermediate host through accidental ingestion of the ova of the tapeworm, and the resulting bladder-worms show a peculiar predilection to invade the brain. The majority of persons who develop cysticercosis do not seem themselves to have harboured a tapeworm.

In cases where it is not possible to excise a cyst, Fairley's complement fixation test is stated to be a valuable aid to diagnosis.

The high standard in general surgery, to which we referred last year, has been maintained. We have already mentioned the success attained in the operations for appendicitis.

A new field dressing has been introduced. The pattern is the same as the old one, but the cyanide gauze has been replaced by gauze soaked in 1-1,000 acriflavine, which is claimed to be non-irritating. Before the dressing is sealed up it is subjected to a temperature of 250° F. for thirty minutes.

An event of the year was the opening of the new out-patient block of the Queen Alexandra Military Hospital at Millbank by H.R.H. the Prince of Wales. The new wing contains medical out-patient, surgical out-patient, radiological, massage and electrical, ear, nose and throat, skin, ophthalmic and dental departments and a pathological laboratory. That an out-patient block with accommodation for special departments was required is evident from the fact that the surgical specialist alone saw 768 out-patients last year; in the radiological department 2,468 cases were examined, and in the ear, throat and nose department work has steadily increased for the past ten years.

In the section devoted to hygiene it is reported that the sanitary improvement of barracks and married quarters is being carried out as far as money can be made available. At Hong Kong, owing to the failure of the rains, considerable difficulty with the water supply obtained. A new dam and catchment area in Aberdeen Valley are being provided, which will give a daily supply of 2,120,000 gallons of water.

In the report from the pathology department there is a very interesting note on an investigation of antibody production in a number of bacteriologically-proved cases of typhoid fever among civilians in south-west London. A comparison of the antibodies in the blood of these cases was made with those in the blood of a series of recently inoculated men. The results showed that after six months the inoculated men had considerably more agglutinins in their blood than the recovered cases of infection, in whom they were almost negligible. It is considered that these observations support the view that a state of immunity is not necessarily dependent on preformed antibodies in the blood and tissue fluids.

Clinical and other Notes.

SOME NOTES ON TWO CASES OF GLANDULAR FEVER.

By Lieutenant-Colonel P. POWER

and

Captain F. T. BOUCHER,

Royal Army Medical Corps.

In view of the recent outbreaks of glandular fever in different parts of the country, it is thought that some notes on two recent cases of this disease may be of interest. Both cases were recruits from Derby and occupied the same barrack room at Normanton Barracks, sleeping on different sides of the room but in beds exactly opposite.

Glandular fever was first described by Pfeiffer in 1889. Dr. H. Letheby Tidy, F.R.C.P., in the *Lancet* of July 7, 1923, gives an interesting account of this condition following his investigations of an epidemic which occurred at a boys' school. A master appears to have contracted the disease first and there were twenty-four cases amongst the boys. The following is taken from Dr. Tidy's paper :—

Glandular fever is an acute infectious and contagious disease principally of, but not confined to, childhood. It is characterized by a rapid and marked enlargement of the cervical glands and by a less constant and less marked enlargement of the spleen, axillary, inguinal and other glands. The cervical glands may be tender and acutely painful. Abdominal pain is sometimes severe. The fauces are often reddened and a tonsil may be enlarged. There is no anæmia in the acute stages. There may be preliminary malaise, the glands appearing about the third day and reaching a maximum in one to three days. With the swelling there is pyrexia usually 103° F., but it may reach 105° F. for a day or two. It rarely exceeds 100° F. for more than a week. The prominent mass of glands usually subsides in five to fifteen days, but may relapse, or if unilateral may occur on the opposite side. Suppuration is extremely rare. Glands in the neck remain palpable for several weeks or may be for months. After the acute stage there is generally a prolonged period of slight depression of health and anæmia. The most definite complication is a hæmorrhagic nephritis. This is without any definite manifestations of renal disturbance. The parotid is not affected.

The condition has no relationship to mumps, whooping-cough, measles, scarlet fever, tonsillitis, leukæmia, Hodgkin's disease, tuberculosis or infection with pyogenic organisms.

Notes on the Epidemic.

Glandular enlargement was largest in the neck in all cases. The glands were mostly in the usual site deep below the sterno-mastoid. The swellings came on rapidly. The axillary glands were palpable but never formed a visible mass. The mesenteric glands were palpable in a considerable proportion of cases. Abdominal pain occurred in several cases, in one suggesting appendicitis.

There was no exudation on the tonsils but the fauces were reddened in several. Epistaxis occurred in eight cases.

The spleen was palpable only in one case and another factor accounted for this.

There were no instances of vomiting and diarrhœa.

Definite relapses occurred in two cases. In one instance four weeks from the onset and in the other five weeks.

In almost all the cases it was very difficult to classify many of the mononuclear cells as large or small lymphocytes. The main mass of the protoplasm is usually greater than is normal in small lymphocytes and stains more deeply. The nucleus is less regular and is frequently notched and often eccentric. There are no nucleoli. A considerable number of typical lymphocytes is always present. These abnormalities in the lymphocytes have been carefully described by observers of infective mononucleosis and also by previous recorders of such cases. The nucleus of the most atypical cells has some resemblance to a small-sized Rieder nucleus.

The incubation period was from ten to twelve days.

Conclusions.

(1) Glandular fever is a clinical entity.

(2) An absolute lymphocytosis is a normal occurrence.

(3) Glandular fever and the condition described as mononucleosis are identical.

(4) Recovery is permanent and there is no relationship to leukæmia, Hodgkin's disease or tuberculosis.

(5) There is no evidence that sepsis is a cause of absolute lymphocytosis.

Further references to the disease may be found in a letter from Dr. Tidy to the *British Medical Journal* of May 10, 1930, and in an article published in the same Journal of June 7, 1930, and communicated by Drs. Evans and Robb of St. Bartholomew's Hospital.

Our present knowledge of glandular fever may be summarized as follows:—

(1) Glandular fever is an acute infectious and contagious disease of, but not confined to, childhood. It is characterized by rapid and marked enlargement of the cervical glands and by a less constant and less marked enlargement of the axillary, inguinal, and other glands.

(2) The infecting organism is unknown.

(3) The incubation period is between five and twelve days.

(4) The duration of infection is uncertain. Tidy has provisionally laid down its duration as (*a*) until the temperature has been normal for a week, (*b*) the greater part of the glandular swelling has subsided and there is no tenderness, (*c*) the fauces are clear.

(5) The degree of infectivity is not high. Tidy states that he has never seen an obvious case of infection in a hospital ward. On the other hand, susceptibility to mass infection is very high, such as in schools.

(6) Males are more often attacked than females.

(7) The onset is sudden with malaise, reddening of the fauces and perhaps enlargement of the tonsils. Signs of sepsis or exudation are slight or entirely absent except in patients with previous tonsillitis.

(8) There is no typical rash. Erythematous, papulo-macular, or urticarial eruptions may be present, but rashes of any type are rare. Some authorities deny their association with glandular fever.

(9) There may be an irregular fever extending over several weeks.

(10) The enlargement of the lymphatic glands is most marked in the cervical region and generally appears first in that region. This is not always the case, as early involvement of the mesenteric group may occur giving signs and symptoms of appendicitis. The enlarged bronchial glands may cause cough of a paroxysmal nature resulting from pressure on the bronchus. The cervical glands may be uncomfortable, but their size is out of proportion to the degree of tenderness or to the faucial symptoms. They are generally discrete and very rarely suppurate. The axillary and inguinal glands may be enlarged but not to the same extent as the cervical.

(11) The spleen is slightly enlarged in some cases.

(12) The blood. A mononucleosis is the rule. This, however, may be transitory. There is an increase in the number of the lymphocytes, but it would appear that there is a certain difficulty in classifying a certain percentage of the cells found. In some cases there has been a striking increase in a variety of immature forms resembling large, mono-nuclear cells.

(13) Complications. Hæmorrhagic nephritis occurs in some cases, without any definite manifestations of renal disturbance.

(14) Relapses may occur even four weeks after the onset.

(15) The treatment is symptomatic.

Case 1.—Private A. B., aged 18, service 4/12 year. Unit: Depot, Sherwood Foresters. This man while on guard duties on June 8, 1930, was taken ill suddenly with headache, shivering, and giddiness and was taken to the Reception Station at the barracks. Temperature on admission 101° F. On the following day headache persisted and muscular pains were present. No physical signs were found in the chest or abdomen. Heart sounds were normal. The pharynx was inflamed. The spleen was not palpable and all reflexes were normal. No vomiting or diarrhœa. There was a roseolar rash over the abdomen, back, arms and legs. On June 10 headache disappeared and patient stated that he felt quite well. On June 11

temperature rose to 101·6° F. and all the previous symptoms returned. Patient's condition remained in this fluctuating state until June 17, when he was transferred to the Military Hospital, Lichfield.

On admission to Lichfield his condition was as follows:—

There was a profuse rash over arms, legs, and trunk. The spots were discrete with a diameter of about three millimetres. Temperature 101° F., pulse 110. No physical signs in the lungs. Heart sounds normal. All reflexes present and normal. Urine normal. Complained of abdominal discomfort, but nothing abnormal detected. Spleen not palpable. Pharynx appeared normal. There were glands to be felt in the anterior triangle of both sides of the neck and in the axillæ and groins. The enlargement appeared to be simple. The glands were discrete and were not tender. A Widal was negative; Wassermann was negative. Blood-culture was sterile. The blood picture was normal except for some large white cells. There was never any albuminuria.

The progress was interesting. The temperature varied from normal or subnormal to 101° or 102° F. Patient would have a day with a normal temperature when all symptoms would disappear together with the rash. The following day the temperature would rise to 101° or 102° F. The rash would return together with headache, muscular pain, etc. This state of affairs continued for five weeks. Right through this febrile period the pulse remained very slow. Even with a temperature of 102·6° F., the pulse was only 92 and generally the rate was between 60 and 70. The glandular condition remained about the same during this period. On July 21 Dr. F. W. Marshall, C.M.P., attached to the hospital, suggested that an injection of sulfarsenol might help in the treatment which so far had been entirely symptomatic and 0·2 grm. was given intravenously. The effect was wonderful. After one more rise on July 23, the temperature dropped to normal on July 24 (the forty-seventh day of the disease) and remained normal for the rest of the patient's stay in hospital. A second injection of sulfarsenol was given on August 1.

There were no further symptoms. The rash did not return and all the glands disappeared. Convalescence was uneventful, there were no complications and no relapse.

The patient was discharged to duty on August 17 after a stay in hospital of seventy-one days.

Case 2.—Private G. G., aged 18, service 5/12 year. Unit: Depot, Sherwood Foresters.

This man was admitted to the Reception Station, Derby, on June 20, 1930, complaining of shivering, headache, and sore throat. He stated that he felt ill the previous day when at musketry on the range. On examination patient looked ill and had a temperature of 99·6° F. The glands were enlarged on the left side of the neck, the skin over them being red and tender on pressure. Left tonsil was inflamed; tongue coated and moist. No physical signs in the lungs. Heart sounds normal. No tender spot in the abdomen, spleen not palpable. All reflexes present and normal. On

the following day headache became severe and a yellow deposit formed on the left tonsil. There was pain on movement of the head due to the swollen glands on the left side. Some dysphagia. Temperature 99·6° F., pulse 100. A throat swab proved negative to K.L.B. and the patient's condition remained much the same until June 26, when he had a rigor, temperature rising to 104·6° F. accompanied by vomiting.

On June 27 the patient was transferred to the Military Hospital, Lichfield.

On admission his temperature was 99·4° F. Nothing abnormal was detected in the chest, abdomen, or central nervous system. No albuminuria. Enlarged glands were felt in the axillæ, groins and neck. The glands in the neck formed a solid mass beneath the left sterno-mastoid muscle and were very large. A rash was present over the buttocks, but there were no spots on the rest of the body. The day after admission patient had a rigor, temperature rising to 105·2° F. Temperature remained more or less quiescent from this time until July 6, when it rose to 100° F. and in the succeeding fortnight fluctuated between 100° and 102·4° F. During this period patient felt no symptoms, and on inquiry replied always that he felt quite well and was anxious to get up. The glands continued swollen especially the mass in the left side of the neck which showed signs of suppuration. This, however, never occurred. On July 21 sulfarsenol 0·2 grm. was given and improvement was at once noted. The temperature never rose above 100° F. and the glands in the neck slowly disappeared. A second injection of sulfarsenol was given on August 1, and on August 4 temperature became normal for the first time. This was on the forty-sixth day of the disease. All symptoms disappeared and it was thought that the patient was convalescent.

Unfortunately, three days afterwards, his temperature rose suddenly to 102·2° F. with a pulse of 96 and a respiration rate of 36. Signs of fluid in the left chest developed with much cough and a muco-purulent expectoration. An exploring needle showed fluid which proved sterile. During the following month the sputum was examined repeatedly for T.B. and the result was invariably negative notwithstanding the fact that the patient presented all the clinical signs of tuberculosis of the left lung. So ill indeed had the patient become that his life was despaired of. On September 25 his condition commenced to improve. The temperature began to show signs of settling and in one week he gained 4½ lbs. in weight. On October 2 a further increase in weight was noted. Cough and expectoration became much less and the temperature finally came to normal on October 31 and remained normal until his discharge from hospital. During convalescence his weight increased steadily. On November 27 he was brought before a Medical Board and invalided owing to his chest condition which was one of chronic pleurisy and fibrosis of the left lung. He left hospital after a stay of 163 days.

The chief points of interest in these two cases of glandular fever are:—

(1) The question whether the injection of sulfarsenol had any curative effect on the disease. In Case 1 it did certainly seem to act in a miraculous fashion. After the first injection the patient never looked back, there were no complications and no relapse occurred. In Case 2 the temperature became normal for the first time after the second injection, but unfortunately, a complication set in shortly afterwards.

It is interesting to note that in both cases cessation of fever occurred on or about the forty-sixth day of the disease.

Two cases are of course too few for any conclusion to be come to as to the value of sulfarsenol treatment in glandular fever, but it is thought that it should certainly be tried in any other cases which may occur.

(2) These cases certainly bear out the contention that the disease does not possess a high degree of infectivity. No case occurred amongst the nursing orderlies and there were no further cases in the hospital.

(3) The incubation period in Case 2 was twelve days.

(4) The appearance and disappearance of the rash in Case 1 coincident with the febrile and afebrile days has not apparently been noted before.

(5) No enlargement of the spleen was noticed in either case.

(6) The blood picture showed a lymphocytosis in both cases.

(7) The acute serous pleurisy in Case 2 has not been described before as a complication of glandular fever.

We are indebted to Major Swayne, O.B.E., R.A.M.C., Military Hospital, York, for the notes on the literature of the disease.

A NOTE ON BALANTIDIUM COLI.

By Major C. J. H. LITTLE, O.B.E.,
Royal Army Medical Corps.

Whilst in charge of a laboratory in India, a stool was brought to me for examination which was found to contain, besides much blood and some mucus, swarms of active *Balantidium coli*. The majority were swimming rapidly and freely in all directions, but already some few showed the peculiar rotatory movement said to presage their death, that is, a rolling motion round the long axis in one direction, followed by a pause and a reversal in the other direction.

Some writers have given their opinion that, if more frequent microscopical search was made, balantidiosis would be found to be more common than at present appears to be the case. It seemed worth investigating, therefore, whether *Balantidium coli* might not resemble *E. histolytica* in the rapidity with which it becomes unrecognizable in the standing stool, since such a characteristic would account, at least in part, for the difference between the recorded and the estimated incidence of the disease.

The stool had been passed about one hour before the first examination. A second cover-slip preparation was therefore made one hour later. The stool, which was faintly alkaline to litmus paper, was covered by a cloth between the two examinations; the temperature of the laboratory was 80° F. and the atmosphere was moist, so that the general conditions would appear to have been favourable to survival.

The change seen in the second preparation was startling. In place of swarms of lively protozoa there were a very few sluggishly moving parasites rolling to and fro in one spot, as described above. Amongst the red blood corpuscles were numerous small clear areas. Some of these contained the whole or part of the ectoplasm of a protozoon, enclosing some refractile granules, while the remainder were empty of all visible contents, but, judging from their size, may have been filled with perfectly clear protoplasm from disintegrated protozoa.

It seems then that one of the reasons why infection by *Balantidium coli* is not found more commonly may be the difficulty of microscopical diagnosis due to the very rapid breaking up of the vegetative forms. On the other hand it is possible that these were adversely affected in this case by the unusually large quantity of blood present, the result presumably of the erosion of a vessel in an ulcer.

The patient, an Indian grass cutter, denied any association with pigs, but his occupation would appear to have exposed him to the possibility of infection from their droppings.

Echoes of the Past.

THE ARMY MEDICAL SERVICE IN INDIA, 1840-53.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 228.)

The Gwalior War of 1843.

This war, the result of a dispute about the succession, was decided in two battles fought simultaneously at Maharajpur and Panniar on December 29, by two columns led by Sir Hugh Gough, the Commander-in-Chief in Bengal, and Sir John Grey respectively. In the first the Mahrattas put up a stiff fight, our casualties being eight per cent, half of which were borne by the 39th and 40th regiments. Superintending Surgeon Andrew Wood and Field Surgeon Alexander Chalmers of the Company's service were mentioned in Sir Hugh Gough's despatches, and also Assistant Surgeon Stephens of the 63rd, on the Commander-in-Chief's staff. Stephens we may be sure well earned this distinction,

if only for the fact that the Governor-General and a party of ladies were present as Sir Hugh's guests. The elephants which carried the ladies came at one time under heavy fire, and the ladies got out of hand. As the honour "Maharajpore" or "Panniar" is borne by five British regiments, the names of the regimental medical officers engaged may be recorded so far as they have been ascertained. *Maharajpore:* 16th Lancers, Samuel

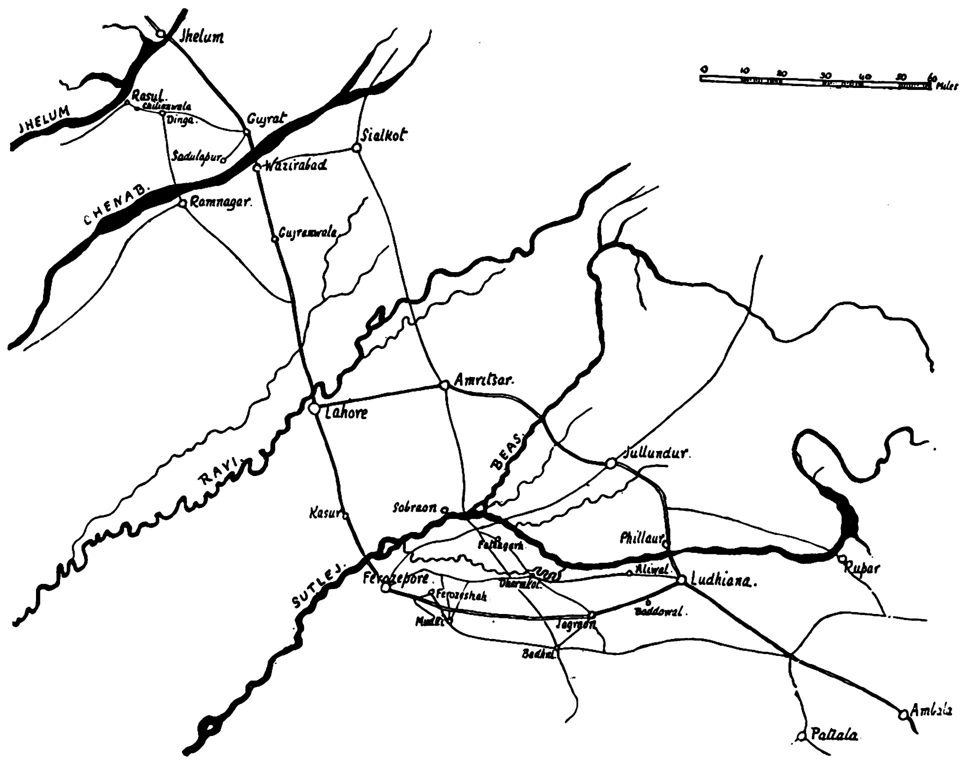


Fig. 1.

Currie, Charles A. Gordon; 39th (1st Dorsets),[1] Charles H. James; 40th (1st S. Lancs.), James McAndrew, Henry Mapleton, John H. Brummell. *Panniar:* 9th Lancers, Arthur Wood, W. G. L. Staunton; Buffs, Robert Stevenson, John A. Bostock; 50th (R. West Kent), Jas. Davidson.

The First Sikh War, 1845.

The death of Ranjit Singh in 1839 left the Punjab in a state of anarchy, with a powerful and well-trained army ready to engage in any enterprise where loot could be acquired. The menace to the peace of British India was clear, but to avoid precipitation of hostilities by a too obvious

[1] Their Surgeon, Robert Starke, M.D., died of cholera at Agra during the concentration.

concentration, our troops were kept somewhat widely dispersed along the frontier.

When in December, 1845, the Sikh army crossed the Sutlej and invaded our territory, there were small garrisons at Ludhiana and Ferozepore, but the nearest assemblage of any considerable body of troops was at Ambala. Ferozepore was at once partially invested, and Sir Hugh Gough, the Commander-in-Chief in India, set out for its relief. Lord Hardinge, the Governor-General, accompanied the Army, which, in spite of the great difficulty in collecting transport at short notice, was hurried forward by forced marches. Having accomplished 100 miles in five days, the force reached the village of Mudki, about twenty miles from Ferozepore, on December 18. Stragglers had been numerous, and both British and Indian troops were much exhausted. The number of doolies attached to each of the Queen's regiments should have been seventy-five, but these were very deficient. One unit secured twenty-four, only half of which came in at the end of the march.

In accordance with custom, the Medical Board detailed a Superintending Surgeon and a Field Surgeon of the Company's establishment to accompany the Army, but all arrangements were made difficult by the failure to form any depot of medical or surgical stores within easy reach of the threatened point. In the first two engagements of the war there were neither instruments nor material to form a field hospital, other than those carried by the regimental surgeons.

On the evening of the 18th the Sikhs attacked in force. The country, which was dead level, was covered with confused jungle. After an hour's hard fighting, a general advance was made and the enemy retired. The number engaged on our side was 16,700. There were 872 casualties, 506 of whom were Europeans. Sir Robert Sale was mortally wounded. Assistant Surgeon Alexander Graydon of the 50th, who received a bullet wound of the abdomen, died after removal from the field.

After the engagement the wounded and stores were left at Mudki with a guard of Indian troops, while the rest pushed on towards Ferozshah, a village about nine miles from Ferozepore, where the Sikhs had fortified a position. The Superintending and Field Surgeons remained behind. No written orders were issued even to the divisional commanders. "The Army was one unwieldy battalion under one C.O. who had not been granted the power of ubiquity."[1] On the afternoon of the 21st, Gough's army, 16,500 strong, found itself in the presence of the enemy and an immediate assault was ordered. There was a most obstinate resistance. When darkness fell only a corner of the entrenchment had been secured, all reserves had been thrown in, and the situation of the Army on a flat plain swept by the medium artillery of the Sikhs was precarious. The men passed the night without food or water under constant fire; the

[1] Autobiography of Sir Harry Smith.

wounded lay on the ground uncollected. In the morning the line was reformed and the position carried. The fight had lasted thirty-six hours.

The aspect of the battle and its sequel from the point of view of a regimental medical officer is described in a private letter received and sent to the *Lancet* by George Guthrie, the great surgeon.

"December, 1845. I have just brought in the wounded of our regiment to this station [Ferozepore] where there is a commissariat and some accommodation. They are 175 in number. I am here single-handed, the regiment being encamped about four miles off. The labour I have undergone has been excessive. I am one of four, three of whom are absent. One claimed the sanitary depot, a second was left at Kassowlee, a third is in camp with the regiment, and I am here alone. How can I be expected to practise scientific surgery surrounded by 175 wounded men all clamouring and beseeching for assistance? I have no time to do anything satisfactorily. I have, however, managed to do four amputations to-day, and dressed the greater number of serious cases, including two amputations I brought off the field, and am weary of the bloody work. We had in the field with us a quantity of water, some brandy, wax candles, and a fair proportion of medical and surgical stores, and followed close in rear of the regiment till the men began to drop around us chiefly with horrible wounds from cannon shot which the enemy fired with wonderful rapidity. We halted under a tree, the only shelter to be had, the country being a sandy plain as level as a table, and the hospital soon became a dreadful scene of mangled bodies. The men of the band brought in the wounded, and we were getting on well when a great misfortune befell us. I do not know, nor can I believe, that ours was the only field hospital of the division, but certain it is we were soon besieged by wounded from every corps. Cavalry and artillery came galloping in and carried off our dhoolies. When it was discovered we had water there was an end of all order. We could only save one small vessel full by placing it in charge of a sentry with a loaded musket. When it became dark we lighted our candles, but we had scarcely done so when an order came to put them out or the Sikhs would be down on us. Shortly after this we were told to join the regiment, but in the dark no one could tell where it was. It was said to be on the right, but by sad mischance we wandered down to the Sikh camp, when the enemy began to fire on us. We all made off as fast as we could, the dhoolie-bearers throwing down their loads, which ended our hospital establishment. We could not with our deficient means carry off the wounded from our field hospital, and we saw many poor fellows lying near the entrenchment we could not remove."

Our losses were 700 killed and 1,720 wounded, of whom far the greater proportion were Europeans. The 62nd lost half their strength. Assistant Surgeon R. B. Gahan of the 9th was wounded on the second day, and died after amputation of the thigh. Dr. Hoffmeisther, surgeon to Prince Waldemar of Prussia, was shot through the head. Surgeon W. L.

McGregor of the Bengal European Regiment, in his description of the battle, also comments on the absence of any medical organization. The walking wounded tried to make their way back to Ferozepore, where several arrived on the evening of the 22nd. A panic started among the camp followers at one period of the battle, and practically all the doolie bearers threw down their loads and bolted. The Commissariat Officers at Ferozepore, by the most commendable exertions, managed to collect fresh bearers, elephants, and bullock carts, by which the wounded were eventually got in to the entrenched camp at the cantonment. On the morning of the 23rd some of the regimental surgeons having returned from the field, they were moved into the barracks of the 23rd regiment. Here they were by the personal exertions of the Governor-General, provided with every comfort possible, and by his orders a commissary was detailed to attend to their feeding. Meanwhile the P.M.O. appears to have been still at Mudki. The enemy recrossed the river, and our troops advanced another five miles. Diarrhœa was prevalent, ascribed to the contamination of the wells at Ferozshah with gunpowder. The horrible taste of the water and its ill-effects may equally well have been due to excess of natural salts, a common enough phenomenon in the surface water of the district.

During the first weeks of January the Commander-in-Chief was awaiting reinforcements and heavy artillery, and no move was made. Towards the end of the month the Sikhs began to threaten our communications at Ludhiana, and Sir Harry Smith was despatched with a part of the force to effect a junction with the garrison. Crossing the front of the enemy's army at Buddiwal on the 21st, a considerable part of the transport was lost, and the wounded from the engagement, with whom was Assistant Surgeon R. Banon of the 62nd, fell into the hands of the Sikhs. It is feared that most of the wounded were murdered. Banon, after much maltreatment was eventually released and lived to become a Deputy Inspector-General. On January 28, Sir Harry Smith, with 12,000 men, attacked the enemy's camp at Aliwal, and drove the Sikhs over the river with heavy casualties. The official despatch states that "owing to the judicious arrangements of Dr. Murray, Field Surgeon, every wounded officer and soldier was placed under cover and provided for soon after dark; and to the zeal displayed by this able and persevering medical officer and to the several regimental surgeons are the wounded and our country deeply indebted." The following day a hospital was opened at Ludhiana.

Meanwhile the main body of the Sikh army was entrenching itself on both sides of the Sutlej round Hariki and Sobraon. The heavy guns having arrived, the position on the south bank was carried on February 10 after an intensive bombardment. Our losses in a force of 17,000 were 320 killed and 2,063 wounded. The medical arrangements appear to have been satisfactory. Dr. B. W. Macleod, the Superintending Surgeon, Field Surgeon Graham and the Medical Department generally were thanked in despatches, as well as Assistant Surgeon J. E. Stephens, who accompanied

Sir Hugh Gough into action, always a risky proceeding, and Dr. Walker, the Governor-General's personal surgeon, of whom it was remarked that "his ability is only to be equalled by his zeal and humanity."

This was the last battle of the war. The wounded were removed to Ferozepore, whence they were transferred later to convalescent depots at Meerut, Landour and Sabathu. Men with amputation stumps were sent down the river for transfer to England.

Speaking of the surgery of the campaign, Surgeon McGregor says,[1] "The necessity for promptitude [in amputation] was well exemplified by what occurred in some regiments, where hardly an amputation succeeded when performed at a late period. In all engagements, in India at least, the sooner a limb is lost after it has been wounded, the greater will be the chance of success. Hence the necessity for a field hospital is an important point which will not, it is hoped, be overlooked in future wars." Regarding the work of the regimental surgeon during an action, he wrote, "In whatever situation a battle may take place in India the duty of the regimental surgeon is to be with the wounded, no matter whether they be in the field or at a depot near at hand, until all capital operations are performed." He deprecated the view, apparently held by some commanding officers, that the surgeon should leave this work to an assistant rather than fall behind the regiment.

In India up to this time there was no surgical staff to supplement the regimental establishment other than the Superintending and Field Surgeon. The former was both administrative medical officer and consultant, the latter controlled the field hospital, if one was formed, under the Superintending Surgeon's orders, and did major operations, assisted by such junior regimental officers as could be spared. The system did not allow for two engagements fought within three days of each other in different localities. The muddle at Ferozshah, where neither Superintending Surgeon nor Field Surgeon were within twenty miles of the action, was resented at home, and in the next campaign an Inspector General was appointed for the Queen's troops.

Except that the staff was usually inadequate and overworked, the field general hospitals were well run, and the treatment received by the wounded at the hands of the Company's surgeons was beyond criticism. Sir Herbert Edwardes, who, as a subaltern, was wounded at Mudki, testified to the comfort and cleanliness of the field general hospital and the good attention he received from both surgeons and subordinates. It is probably correct to say that our field hospitals throughout the nineteenth century were the envy of all other nations. The hospitals criticized by Dr. Russell at Scutari, in 1854, and by Sir Garnet Wolseley in 1882, were field hospitals overcrowded through no fault of the doctors, and expected, with their limited

---

[1] W. L. McGregor. "History of the Sikhs."

resources, to perform the rôle of the present-day general hospital. Comfortable base hospitals were no doubt gradually evolved as the war proceeded, and also in many of our wars from the Peninsula onwards, but to send them out specially equipped beforehand is a comparatively modern development.

Medical Officers, British Service, First Sikh War.

9th Lancers: A. Wood, A. Stewart, W. G. L. Staunton. 16th Lancers: R. J. C. Grant, Samuel Currie. 3rd Light Dragoons: H. Franklin, F. Laing. 9th (Norfolks): D. Anderson, P. Mackey. 10th (Lincolns): H. C. Foss, J. Macbeth. 29th (Worcesters): J. R. Taylor, W. B. Young, W. Baker. 31st (East Surrey): P. Gammie, R. B. Gahan (killed), D. Stewart. 40th (S. Lancs): E. M. Macpherson. 50th (R. West Kent): J. Davidson, J. Burke, A. Graydon (killed). 53rd (K.S.L.I.): T. G. Logan, A. Gordon, C. H. Fasson. 62nd (Wiltshire): R. Wood, W. Rutherford, R. G. D. Banon. 63rd (Manchester Regt.): Richard Dane. 80th (2/S. Staffs): A. S. Macdonnell.

THE SECOND SIKH WAR, 1848-49.

After the Sutlej campaign a brigade of British troops was stationed at Lahore, but there was no real settlement of the Punjab. The second Sikh war commenced with the murder of two of our political officers at Multan, the investment of the town by General Whish and a temporary withdrawal on account of the defection of the Sikh auxiliaries under Sher Singh, who were supposed to be co-operating. Multan was eventually assaulted and occupied on January 29, 1849, our casualties in a force of 15,000 being 210 killed and 928 wounded. The General stated in his despatch that "Superintending Surgeon T. E. Dempster had uniformly and successfully applied his talents and assiduity to the promotion of the health and comfort of the sick and wounded, and been ably supported by the medical officers of every corps and department." Meanwhile Sir Hugh Gough had engaged the Sikh army, now openly hostile, at Ramnagar (November 21) and Sadulapur (December 3), after which he crossed the Chenab, and on January 13 fought one of the most stubborn fights in the history of the British army at Chilianwala. Our losses in a force of 12,000 were 731 killed and 1,446 wounded, by far the greater proportion of the casualties were among the European regiments. The action terminated at night, and was indecisive. Owing to the absence of water and supplies our men were withdrawn after the battle, but not before every wounded man had been collected. The night was one of incessant labour to the surgeons, and the rain descended in torrents. On the morning following the dead were piled on camels and carried to the rear, where the officers were laid in one trench and the men in another. Besides Dr. Charles Renny, the Superintending Surgeon and Dr. J. Macrae, the Field Surgeon, a Deputy Inspector, H. Franklin, was present as Inspector of Hospitals for the Queen's troops. Though the

regimental dressing stations came under fire there were no casualties among medical officers. A field hospital was formed sufficiently close up to be temporarily thrown into disorder by the unfortunate retrograde movement of Pope's cavalry brigade, which rode through it and upset several of the doolies.

The Queen's and the Company's troops appear to have had separate field hospitals during the Punjab campaign. Of the work done by the British field hospital there is, unfortunately, no record. A report was published on that of the Indian army, showing that it was well provided. The staff comprised a field surgeon, storekeeper and 13 assistant surgeons, all commissioned officers; 2 uncovenanted physicians, a sub-assistant surgeon, 2 apothecaries, 3 stewards, 10 hospital apprentices, 6 native doctors and 2 hospital sergeants. This hospital received no more than 504 surgical cases. Of these 284 were Europeans.[1]

The war ended with a decisive victory at Gujrat on February 21. The good services of Renny, Franklin, and Macrae were referred to in despatches. Franklin was among the first batch of army surgeons to receive the C.B. in 1850.

There was no adverse criticism of the medical arrangements during the war. Some of the lessons of the Sutlej campaign were evidently applied, and with good results.

Medical Officers, British Service, Second Sikh War.

Inspector of Hospitals: Deputy Inspector Henry Franklin.

3rd Light Dragoons: James Henderson. 9th Lancers: R. J. C. Grant, E. M. Macpherson, W. G. L. Staunton. 14th Light Dragoons: A. Stewart, R. B. Wigstrom, C. H. Fasson. 10th Foot: E. Mockler, J. G. Inglis, J. Macbeth. 24th: G. K. Pitcairn, W. J. Furlonge, A. Gordon (52nd), W. Hanbury. 29th: L. C. Stewart, W. G. Trousdell, A. M. Macbeth. 32nd: C. Scott, E. Moorhead, A. P. Cahill, J. Dunlop. 53rd: N. Dartnell. 60th: C. R. Boyes, W. J. Macfarlane, D. P. Barry. 61st: F. H. Clarke, W. H. Jephson. 63rd: Richard Dane.

The Second Burmese War, 1852-53.

The Burmese war of 1824 with its phenomenal death-roll was one of the most costly, worst thought out, and worst found expeditions ever undertaken by the Government of India. The campaign of 1852, fought under much the same exhausting conditions of damp heat, amid tropical jungles and swamps, claimed inevitably many victims from disease; but, in the arrangements made for the maintenance of the Army, we can note a definitely increasing appreciation of sanitary problems, and some genuine and well-directed effort towards their solution. Credit for this was due

[1] *Lancet*, December 14, 1850.

to Sir John Godwin, the Army Commander, but also to Lord Dalhousie, the Governor-General, who maintained throughout a keen personal interest in the men's welfare.

The first expedition had been started during the rains, with the idea that the increased depth of the Irrawaddy would facilitate navigation. The expeditionary force of 1852 was timed to arrive before Rangoon at the

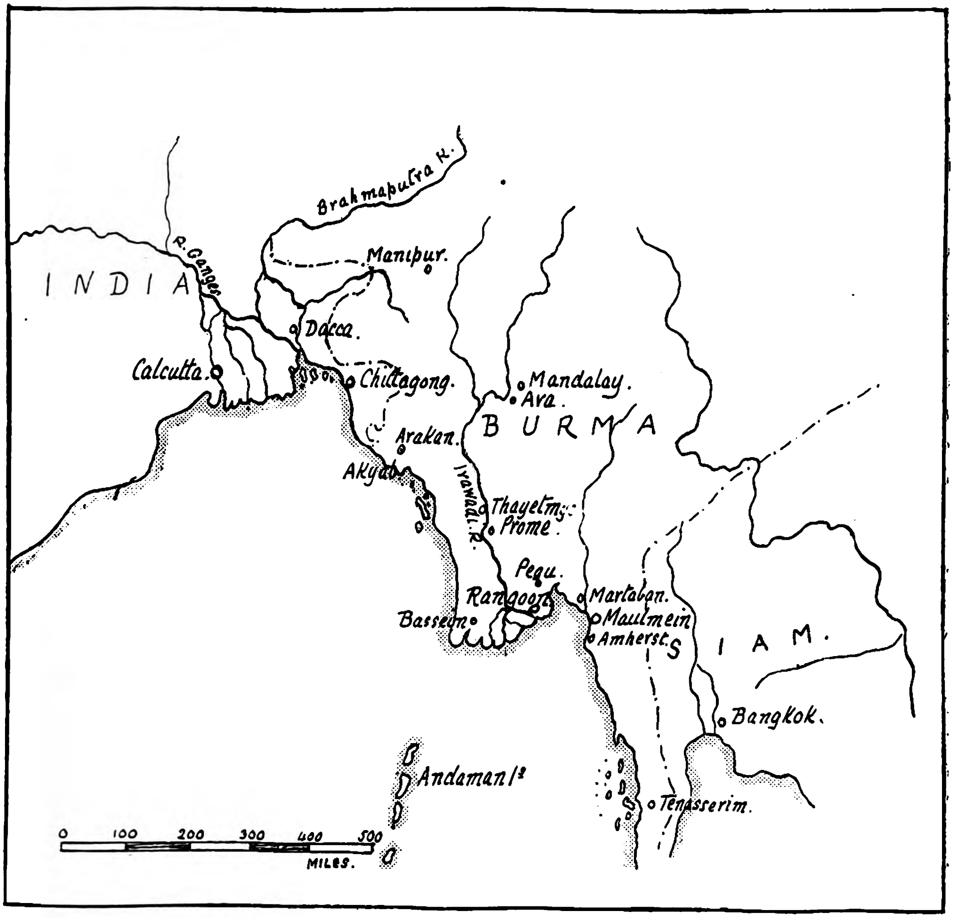


FIG. 2.

beginning of April, six weeks before the monsoon broke. The rations were good, a large stock of cattle was procured to allow of the issue of fresh meat; and wooden huts in sections were sent over from Moulmein in which to house the troops. The problem of clothing was unfortunately not dealt with. The tight coatees and leather stocks, which had proved so conducive to ill-health in China, were retained. Lord Wolseley mentions in his "Story of a Soldier's Life" that the officers of the 80th wore their tight shell jackets and forage caps; some head protection was afforded,

however, by winding pugri cloth round. Their trousers were of Indian drill dyed blue. At this time the Company's officers had begun to adopt helmets, which were much envied, but it was a point of honour with the Queen's regiments to look European.

The original force consisted of about 6,000 men, of whom nearly half were British.[1] A complete and efficient field hospital under Dr. William Montgomerie, the Company's Superintending Surgeon, was embarked on the hospital ship "Tubal Cane," for which, in addition to a subordinate staff, five assistant surgeons were detailed. On arrival, a convalescent hospital was at once established in Amherst, a healthy site across the bay. Steamers were used in this expedition, and the Royal Navy took an active part in the proceedings. Judging from the experience of the 51st (1st K.O.Y.L.I.), the arrangements for sea transport were still primitive. Though the weather was fair, their twelve days' voyage from Madras in the Company's steam frigate "Feroze" was most uncomfortable. "Both officers and men were restricted to the upper gun deck, which had not always even the protection of an awning from the intense heat of the sun by day and dew by night. All had to lie down where they stood with only their great-coats for cover. The paddle-boxes were covered with native followers, and such was the crowded state of the decks that the crew were almost unable to pass about the vessel." There was a death from cholera but, providentially, the disease did not spread.[2]

Sir Joseph Fayrer, one of the staff of the field hospital, has left some of his impressions of the war. The hospital ship having arrived at the mouth of the Irrawaddy, was towed towards Rangoon by H.M.S. "Hermes," and after a bombardment from the river the troops and the field hospital were put on shore. The fortifications of the town were carried on April 14, with a loss of 17 killed and 132 wounded. It was the hottest month of the year, and there were numerous casualties from heat stroke; two officers died from its effects on the field. "Here and there were to be seen on the ground for the advance, to the left of the White House stockade (the enemy's main position), the medical officers and their subordinates administering relief by pouring water over the patients."[3] That night the 51st bivouacked among the burning ruins of the town surrounded by heaps of dead bodies, the stench from which was intolerable. Upwards of fifty men were seized with cholera, of whom forty-two died before morning.

The field hospital was by this time established in a temple. All the sick and wounded were collected at this spot. Assistant Surgeon Fayrer, who was the senior medical officer of the staff, appears not only to have run it very efficiently, but to have fully maintained the dignity of his

---

[1] H.M. 18th, 51st, and 80th Regiments, the 40th Bengal N.I., 4 battalions Madras N. I., 5 companies of Artillery, and 2 of Madras Sappers and Miners.

[2] Wheater. "Record of the Services of the 51st."

[3] W. Laurie. "Our Burmese Wars."

position. Having administered a severe snub to the Brigade Major, who ventured to interrupt when he was making representation to the Brigadier, and gained his point, he was next called upon to receive the Army Commander, a veteran in a wig, whom he handled with no less success. "As it happened," he states, "there was no commissioned officer to receive the General when he arrived. When I got to the steps, he was talking to a subordinate medical officer. On hearing who I was, he turned angrily to me and said, 'There is no one to receive me,' and added something about neglect of duty. I was indignant, and told him there was no neglect of duty; we had worked very hard, and, it seemed to me, satisfactorily. One of my brother officers was sick; of the others, one was in the native hospital and one engaged on some important duty. He said no more then, and we proceeded round the hospital. The sick and wounded, considering the circumstances, were wonderfully comfortable, but we were badly off for clothing. Noting one man whose shirt looked dirty, he said, 'This man has a very dirty shirt. Why is it?' I replied, 'Because, sir, the commissariat is so ill-provided that I have difficulty in getting what is necessary for the wounded. There are no flannel shirts to be had; I am glad you noticed this.' He immediately turned round and said, 'God bless my soul, sir, I am extreemly obleeged to you for telling me this; I will have some flannel shirts sent.' I had supposed myself in his bad books, but he was a fine gallant old soldier, and very just, though hot-tempered. On leaving he embraced me, much to my surprise, and said, 'I am much obleeged to you, my dear sir, for all your kindness to my sick and wounded.'"

A period of inaction followed the capture of Rangoon, during which there was much dysentery and malaria. Bassein and Pegu were occupied, but lack of land transport much impeded the progress of the campaign. This was eventually made good by the importation of elephants from Assam. River transport was frequently available for the part evacuation of casualties, in which the somewhat primitive steamers played a useful part. Otherwise doolies were the regular form of conveyance.

In September the Army was augmented to a strength of 20,000, the reinforcements including the 34th regiment and the Bengal and Madras Europeans. A series of operations was carried out with varying success under trying conditions. The most arduous of these was a campaign of twenty-four days through swamp and dense forest by a mixed force of 1,150 men under Brigadier-General Sir John Cheape against the stronghold of a chief named Myat-Toun. The casualties were 230, of which 100 were due to cholera. Fighting ceased in the spring of 1853, when the whole of Southern Burma passed into our hands.

No official statistics of the loss from sickness in the war were published. The battle casualties were by no means heavy. Of the Royal Irish, 16 other ranks were killed, and 349 died of disease, giving a sick mortality of something like 169 per 1,000 per annum. The deaths from all causes in the 51st were 7 officers and 333 other ranks.

The following served as regimental medical officers in the second Burmese War: 18th (Royal Irish), James Stewart, J. H. Dwyer, W. K. Chalmers; 51st (1st Kings Own Yorkshire L.I.), G. S. Beatson, Thomas Crawford, G. C. Meikleham; 80th (2nd S. Staffordshire), M. W. Murphy (wounded), J. R. Taylor, B. Lane; 81st (2nd Loyal N. Lancs.), G. Auchinleck.

George Beatson was P.M.O., India, 1863-68. Sir Thomas Crawford was Director-General of the Army Medical Department 1882-89. Sir Joseph Fayrer, of the Hon. East India Company's service, who in later life attained almost every possible distinction within his reach, commenced his Army career as an officer of the British Ordnance Medical Department. He died in 1907.

Current Literature.

ELSBY, E. A. **Silicosis Prevention Methods.** Chadwick Public Lecture.

Mr. Elsby stated that in no industry manufacturing or using finely divided silica is the atmosphere completely free from silica dust, and maintained that the weakness of all legislation concerning dust collection lies in the fact that no limiting concentration of silica dust in the atmosphere has been specified.

This omission seriously handicaps both the factory inspector and the manufacturer in deciding what are satisfactory working conditions.

Mr. Elsby discussed in some detail recent work carried out in America by A. E. Russell and co-workers, which had been published in *U.S. Public Health Bulletin* No. 187, and which leads to a permissible dust standard of 10,000,000 particles of granite dust per cubic foot of air being proposed. As this dust contained 30 to 40 per cent silica in the form of quartz, the limiting concentration calculated in terms of 100 per cent silica of particle size less than 10 μ and correctly estimated, would be 3,000,000 particles per cubic foot of air; a figure which can be obtained in industry if correctly designed plant is installed and maintained.

The determination of the amount of silica dust in the atmosphere is a matter of some difficulty and the Impinger method described in *U.S. Public Health Bulletin* No. 144, was advocated in preference to Dr. Owen's Dust Counter, owing to the advantages of chemical analysis of the dust collected, of more accurate dust counting, and greater efficiency at high concentrations.

Whilst the correct designs of hoods and ducts are now well known, it was pointed out that allowance must be made for loss in air velocity between the source of dust and the hood, an all important point which is too frequently missed.

Failure of dust-collection systems was generally due to the installation of unsuitable dust-collectors. The cyclone collector was recommended in

cases where 60 to 70 per cent collection was sufficient and a very fine dust could be vented to atmosphere. This is very rarely possible owing to nuisance, and in general complete collection is necessary.

The plain bag-filter, though a most excellent plant under certain conditions, must not be over-laden with dust if any air is to pass through the filtering medium. One square foot of filtering surface should be allowed for three cubic feet of air per minute, and the amount of silica in the air should not exceed five grains of silica per cubic foot. A collector fitted with thirty-six bags, nine feet long, ten inches diameter, should be capable of dealing with 200-300 pounds of silica in six working days.

The most satisfactory type of collector under all conditions is the bag filter or cloth screen in which the filter is mechanically shaken and subjected to periodical reversed air-blast. A collector of this type can deal with air containing 15 grains of silica per cubic foot, allowing 1 foot of filtering area per 3 cubic feet of air per minute.

Various makes of collectors were described in some detail and lantern slides shown.

Mention was made of some extremely large installations in America.

Mr. Elsby suggested that the plant manufacturer who guaranteed his system to bring the dust concentration down to the limiting figure previously mentioned, would be doing much to reduce the incidence of silicosis.

Barenberg, L. H., Lewis, J. M., & Messer, W. H. **Measles Prophylaxis. Comparative Results with the Use of Adult Blood, Convalescent Serum and Immune Goat Serum (Tunnicliff).** *J. Amer. M. Ass.* 1930, v. 95, 4-8, 1 chart. [23 refs.] [Home for Hebrew Infants, New York.]

The comparative values of these methods of passive immunization were assessed in an institution containing 350 children of whom 150 were under 2 years of age. With regard to adult whole blood 56 actively exposed susceptibles received 30 c.c. and of these 13 were fully protected, 23 developed attenuated measles, and 20 developed the disease typically. The modification of measles due to adult blood was not quite so striking as the attenuation produced by convalescent serum. All of 112 infants not actively exposed and who received the same dose of adult serum remained free from measles. Tunnicliff serum was given in 8 c.c. doses to 38 actively exposed susceptibles in the first 3 days of their incubation period ; all contracted the disease, nor was evidence given of attenuation. Convalescent measles serum was given to 60 actively exposed children in 6 c.c. doses. Of these 44 were completely protected, 14 developed attenuated measles, and in 2 the disease ran its ordinary course. Of 23 children exposed in the same degree as the injected groups but not injected all developed typical measles. The authors conclude that while convalescent measles serum is the most effective prophylactic its application is limited owing to its lack

of availability. Adult blood is of great value in securing attenuation of the disease and is the most practical method of obtaining protection. No protective value could be assigned to the Tunnicliff antiserum.

A. JOE.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

ROLLESTON, J. D. **The Antitoxin Treatment of Scarlet Fever.** Reprinted from *Practitioner*. 1930, v. 125, 236-43. [29 refs.]

The interest of this paper lies in the author's account of his personal experience in treating scarlet fever with antitoxin at the Western Hospital, of which he is Medical Superintendent. Scarlet fever has in recent years become a relatively mild disease, and he has found the serum necessary only in about 10 per cent. of cases. The doses used were usually 30-40 c.c. irrespective of age. Of 450 patients considered here in 214 the benefit was immediate, the general condition improved, the temperature became normal within 24 hours and the eruption rapidly disappeared. In another 200 improvement was definite, but less marked and less rapid. In the remaining 36 no benefit resulted and some died. One injection, in most given intramuscularly, in a few very severe cases intravenously, usually sufficed; 21 had two injections, 3 had three. Serum rashes, usually urticarial, occurred in 202 or 44·8 per cent., and 17 patients gave a pyrexial response and 4 complained of joint pains. The author was favourably impressed by the use of serum in septic cases, and its chief value lay in its power of alleviating the toxic symptoms of the acute stage, though it appeared to have little if any effect in preventing or curing complications. Only one of the series developed a relapse, a fact in marked contrast with previous records in which relapses occurred in more than 4 per cent.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

GIERTHMUHLEN, F. Zur Frage der intrakutanen Pockenimpfung. **[Intracutaneous Inoculation against Smallpox].** *Muench. med. Woch.* 1930, v. 77, 1703-5. [6 refs.]

The author has vaccinated more than 500 children intracutaneously. The injection of 0·1 c.c. of 1 : 40 to 1 : 50 dilution produces an infiltration from the size of a lentil to a hazel-nut, with no disturbance in the general health. Although the lymph is not sterile, no injury was caused and there is no reason to think that the so-called harmless extraneous bacteria are less harmless applied intracutaneously than cutaneously. The reaction was sufficient to produce immunity, as proved by the failure of subsequent cutaneous vaccination. Negative results were rare. It is not necessary to have a trained assistant to help as the mother can hold the child in a suitable position. The syringe should be shaken and the needle changed after every vaccination. Enough lymph for 10 vaccinations can be taken

up at once in a 1-cc. syringe. The technique of the intracutaneous method can be easily and quickly learnt. It is slightly more painful at the time, but it has the advantage of avoiding vaccination injuries and is preferable for primary vaccinations.

O. K. WRIGHT.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

KOYAMADA, I. Sur la période de développement de l'immunité produite par la variole et la vaccination. **[The Time of Development of Immunity produced by Variola and Vaccinia].** *Bull. Office Internat. d'Hyg. Pub.* 1930, v. 22, 1664-5.

Basing his conclusions on three cases vaccinated in the incubation period, and 27 cases after the appearance of symptoms of smallpox, the author concludes that immunity to vaccinia does not exist during the incubation period of smallpox, but that it is present three days after the onset of that disease. The development of immunity to vaccinia as a result of vaccination was investigated in 44 children vaccinated for the first time. The vaccination was repeated at various intervals, and it was found that from the fifth day there were some cases in which the second vaccination did not take, and from the eighth day all the subjects showed themselves refractory, complete immunity having developed. A similar investigation done on subjects who had previously been vaccinated several years before showed that immunity developed more rapidly and was complete in six days.

As regards the duration of immunity, the author considers that 4 per cent of cases have lost their immunity within one year, and 83 per cent within four years. Seven to eight years after vaccination practically 100 per cent. of the cases have lost their immunity. Apparently the presence or absence of immunity was judged by the results of re-vaccination, but no indication is given as to the author's criterion for complete loss of immunity.

O. K. WRIGHT.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

PEIRCE, E. R. **A Method of Determining the Prevalence of Rats in Ships.** *Med. Officer.* 1930, v. 43, 222-4.

The estimation of the degree of rat infestation of ships is of particular importance in connexion with Article 28 of the International Sanitary Convention of Paris, 1926. This Article requires that all foreign-going ships shall be inspected at intervals of six months. If a ship is found to have only a minimum number of rats on board, a certificate of exemption from deratization valid for six months is issued. If there are more than a minimum number of rats, the vessel must be deratized and a certificate valid for six months be issued subsequently. The estimation of rat infestation requires a specially trained staff. In estimating the number of rats, runs, nests and the amount of rat harbourage and of damage to cargo, woodwork, etc., must be taken into consideration, but the most useful guide

is the quantity of rat excreta. In Liverpool, wild rats have been kept in cages and fed on various diets such as are obtainable on board ships using the port. The number of droppings passed in 24 hours, their shape, colour and consistence have been observed and the difference between fresh and stale droppings noted. The number of droppings varies enormously on different diets—thus on a bran diet the average is 128 in 24 hours, whereas on a rice diet it is only 21 in the same period. Differentiation between fresh and stale excreta is not always easy. Not only the diet, but also the local conditions of temperature, humidity, etc., must be taken into consideration. The staff employed on rat estimation studied the characteristics of the rat droppings during the experiments and, applying the knowledge thus acquired on ships they were called upon to inspect, were able to make extraordinarily accurate estimates of the number of rats on board as shown by tables in which the estimates made before fumigation are compared with the number of rats found after fumigation. CHAS. F. WHITE.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

PARK, C. L. L'emploi des écrans pare-rats. [Rat-Guards.] *Bull. Office Internat. d'Hyg. Pub.* 1930, v. 22, 98-107, 4 figs. [1 ref.].

At the meeting of the *Office Intenational d'Hygiène Publique* in May, 1929, the question of the effectiveness of various types of rat-guards and the possibility of recommending a standard type was considered. Dr. Park was requested to report on this subject. The types of guards commonly required are made of galvanized sheet iron, providing no foothold for rats, having one opening only which completely encloses the rope, and in the form of either discs of 3 or 4 ft. diameter or cones of 2-3 ft. diameter. Guards should be maintained perpendicular to the ropes, but this is frequently difficult as wind pressures and movements of the ship causing slackening and tightening of ropes result in displacement. They should be placed near the ship end or the shore end of the rope according to whether it is desired to stop rats getting ashore or getting on board. The disc pattern is equally effective from whichever side it is approached, the cone pattern is only effective when approached from the concave side. On some ropes it is impossible to apply guards owing to the ropes running close to the side of the ship. In such cases tarring must be substituted. It is useless to apply guards to the mooring ropes of a ship with low-free board lying close to the quay. Though either the disc or cone type is effective when properly applied and maintained in the correct position, there are so many difficulties in practice that their value is greatly reduced. Moreover, rats are landed or taken on board in cargo, and can make use of gangways and can swim ashore if necessary. It is therefore suggested that, except in the presence of a real danger of ingress and egress of plague-infected rats, the use of rat-guards seems unnecessary and their value problematical.

CHAS. F. WHITE.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

Reviews.

TECHNIQUE AND RESULTS OF SKIN GRAFTING. By H. Kenrick Christie, M.S.N.Z., F.R.C.S.Eng. London: H. K. Lewis and Co., Ltd. 1930. Pp. xii + 67. Price 7s. 6d.

This book is an effort to interest the surgeon in the treatment by grafting of cases involving "loss of skin."

The three main types of graft, the Thiersch, Wolff and the tube pedicle graft are described in relation to their suitability.

The author is obviously impressed with the use of the Wolff graft and gives a series of cases in which this graft has been successfully used. A good description of the necessary technique in dealing with grafts is given, stress being laid on the importance of maintaining equalized pressure on the graft by means of Stent's composition for ten days.

The author seems to have a personal objection to the use of the tube pedicle graft and in view of the remarkable results obtained by Mr. Gillies in the use of the method, this would seem surprising. His forecast of the possibility in the future of stock cultures of epithelium for immediate use is, unfortunately, at the moment, only of biological interest.

The book is illustrated by cases showing his results, and a number of these are very good. In particular, the treatment of that most disheartening of conditions—chronic ulcer of the leg—by means of massive grafting, seems more than worth while.

J. H. M. F.

A TREATISE ON HYGIENE AND PUBLIC HEALTH. Seventh edition. By Birindra Nath Ghosh, F.R.F.P. & S.Glas., with the assistance of Lieutenant-Colonel A. D. Stewart, I.M.S. Calcutta: Scientific Publishing Company. 1930. Crown 8vo, pp. xxvi + 728. Illustrations 149. Price Rs. 6-8-0, or 10s. 6d. net.

In his work "A Treatise on Hygiene and Public Health, with special reference to the Tropics," Dr. Ghosh has concentrated an enormous amount of material into a comparatively small compass. The title is rather misleading, as "the tropics" to the author really mean Bengal, and his recommendations and illustrations relate to that district, the climate of which is notoriously different from most of India and the tropics generally There are a good many small inaccuracies, e.g., on page 23 it is stated that decaying vegetation in drinking water may give rise to "dysentery" though enteritis is probably meant. Page 227: it is not quite clear why properly tinned provisions should start to decompose within two months of arrival in India, etc. Apart from these errors the book is a very useful volume of Public Health on a small scale. The chapters on Diet and

Clothing, with special reference to the European abroad, are very sound, clear and well written.

Meteorology is dealt with fully and clearly, while the chapter on vital statistics contains everything likely to be wanted by the student or general practitioner.

All the common tropical diseases have been touched on and animal parasitology has been brought up to date.

The book is well got up, and adequately illustrated, though many of the illustrations might be clearer.

In short, it is very good value for the very reasonable price.

N. L.

SURGICAL DISEASES OF THE THYROID GLAND. By E. M. Eberts, M.D. Philadelphia: Lea and Febiger. 1930. Pp. xii + 238. Price $3.50.

For those interested in the diseases of the thyroid, and the management, examination, laboratory work and the operative procedures necessary to deal safely with these cases, this book will be of very great value. Dr. Eberts is not only an expert but an enthusiast. The whole subject is dealt with fully from the anatomical, pathological and surgical aspect. Of great value, too, is the description of the pre-operative care of the patients and much detail is given on this important side of the subject.

The book is well illustrated and written in an attractive style, and can be most strongly recommended as an accurate résumé of the modern outlook in these most difficult diseases.

J. H. M. F.

RADIUM THERAPY PRINCIPLES AND PRACTICE. By G. E. Birkett, M.C., B.A.Cantab., M.R.C.S.Eng. London: Cassell and Co., Ltd. 1931. Royal 8vo, 196 pages, with 6 colour and 13 half-tone plates and 52 text figures. Price 17s. 6d. net.

No book in recent years on the subject of radium therapy deserves a more favourable reception by the medical profession than this volume. It gives us the results of the wide experience of a busy Radium Institute which has attained real eminence in this speciality, together with notes from other similar centres. The bomb treatment and the treatment with surgical access are discussed fairly and placed according to their present known values. Readers will realize that the γ ray is the only one that is employed in the general treatment. In the early part of the book a small reference to "ether vibrations" might be elaborated, if the reader desires this, by referring to Sir James Jeans's "Mysterious Universe."

It is more evident than ever that radium treatment cannot be standardized because neither the tumour sensitivity nor the patient can be standardized. The various sites of treatment, burns, protections, etc., are all clearly discussed and as such are welcome in a not widely-known subject.

The production of the book is deserving of great praise.

D. B. McG.

Notice.

SIXTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY, THE HAGUE, JUNE 15-20, 1931.

Under the Patronage of H.R.H. THE PRINCE OF THE NETHERLANDS.

PROVISIONAL PROGRAMME.

Sunday,	*June* 14.	17 hours.	Meeting of Permanent Committee.
Monday,	*June* 15.	9 ,,	Issue of badges and documents.
			Meeting of Heads of Delegations and National Correspondents.
		14.30 ,,	Official Opening Ceremony and opening of Historical Exhibition.
		19 ,,	Dinner to Official Delegates given by the Netherlands Government.
Tuesday,	*June* 16.	10 ,,	Meeting of all sections.
		15 ,,	*First Question.* The Recruiting, Training, and Advanced Training of Military Medical Officers and Pharmacists.
		21 ,,	Reception.
Wednesday,	*June* 17.	10 ,,	*Second Question.* The Psychoneuroses of War, the Immediate and Remote Effects of War on the Nervous System in Combatants and Non-Combatants.
			Fourth Question. The Preparation and Storage of Medicinal Ampoules in use in the Medical Services, both Naval and Military.
		17 ,,	Tea given by the Red Cross Society to Heads of Delegations.
Thursday,	*June* 18.	10 ,, and 15 ,,	*Third Question.* Methods of Hæmostasis on the Battlefield. Standardization of First Aid Material and the Mode of Application.
			Fifth Question. The After-effects of War Wounds of the Teeth and Inferior Maxilla: their Treatment.
		14 ,,	Meeting of Permanent Committee.
		21 ,,	Government Reception.

Friday,	*June* 19.		Excursion.
			Meeting of Permanent Committee.
			Discussion of conclusions and preparation of agenda for the final meeting.
		19 hours.	Banquet (subscription 10 florins).
Saturday,	*June* 20.	10 ,,	Final General Meeting.

The opening ceremony will take place in the Grand Hall of Gebouw voor Kunsten en Wetenschappen.

Communications on the subjects under consideration are limited to a duration of ten minutes.

Those taking part in the discussion are limited to five minutes.

The latest date for receiving communications is May 15, 1931.

Subscriptions. 10 Dutch florins (16s. 8d.) for members of the Congress; 5 florins for members of the family.

Uniform. The wearing of uniform is optional. For official receptions and evening ceremonies full-dress uniform with decorations is recommended.

Excursions. Additional excursions for three, four, or five days to various parts of Holland are being arranged by Messrs. Thomas Cook and Son, Ltd.

Reduced Fares. The following reductions in railway fares have been arranged :—

In Great Britain.	Single fare and a third for the return journey.
France.	50 per cent reduction.
Belgium.	35 per cent reduction on railways and steamers.

The Southern Railway have arranged for special fares to The Hague via Victoria, Gravesend and Rotterdam by the Batavier Line. Return fare to The Hague: 1st class—£3 11s. 8d.; 2nd class—£2 12s. 9d.

The following hotel prices have been arranged :—

PRICE IN DUTCH FLORINS.

		Room with Continental Breakfast	Room with Full Pension
The Hague—			
Category	A	7.25	14.25
	B	5.50—6.00	11.00—11.50
	C	4.25—4.50	8.00— 8.25
	D	3.50—4.00	6.50— 7.00
Scheveningen (Plage), 10 minutes from the City by electric tramway.			
Category	A	6.25	12.50
	B	5.00	10.00
	C	4.25	7.00
	D	3.00	6.00

These prices are for one person per day in double rooms.

Certain hotels charge extra for single rooms.

Rooms with private baths are charged from 2—4 florins extra daily.

SUBSCRIPTION FORM.

To be sent before May 1, 1931, to one of the following addresses :—

1. Secretariat of the Sixth International Congress of Military Medicine and Pharmacy,
   3, Surinamestraat,
   The Hague,
   Netherlands.

2. Any office of Messrs. Thos. Cook and Son, Ltd.

Name (in block letters)...

Christian Names...

Status and Military Rank..

Address (in block letters)..

....

I wish to receive

...... Congress Membership Tickets at 10 florins each,

...... Family Tickets at 5 florins each,

for which I enclose cheque, money order, notes, to the value of ...... florins.

Signature..

Note.—These tickets are necessary for obtaining reduced rail and steamship fares and for passport and customs facilities.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette*."

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

Vol. LVI MAY. 1931. No. 5.

Journal
of the
Royal Army Medical Corps.

Original Communications.

REPORT ON A TRIAL OF PLASMOQUINE AND QUININE IN THE TREATMENT OF BENIGN TERTIAN MALARIA.

By Major J. A. MANIFOLD, D.S.O.,
Royal Army Medical Corps.

THE synthetic drug, plasmoquine, belonging to the alkylamino-6-methoxy-chinolin group, was first prepared by Drs. Schulemann, Schoenhoeffer and Wingler in the year 1924. It was used in the treatment of bird malaria by Roehl (1926), who found that the drug had a definite destructive action upon the plasmodia of birds, when given in small doses on consecutive days.

It was also employed by Sioli (1926) in the treatment of patients suffering from general paralysis, who had been artificially infected with malaria.

The first observations on the treatment with plasmoquine of patients naturally infected with malaria were carried out by Professor P. Muhlens (1926), in Hamburg, in 134 cases. The daily dosage employed was 0·08 to 0·1 gramme, and, as the results appeared to be very promising, the drug has since been experimented with in most malarial countries.

The literature on the subject is now extensive. From a bibliography supplied by Dr. O. Urchs, M.D., who also kindly provided reprints of some of the most important articles, it appears that up to the end of the first half of 1930 there were at least 325 publications referring to the effects of plasmoquine or "plasmoquine compound" in the treatment of malaria.

The general impression obtained may be summarized briefly as follows:—

(1) Plasmoquine has a definite destructive action on *P. vivax* and *P. malariæ*.

(2) It has no destructive effect on the trophozoites of *P. falciparum*, and has even been reported as exercising a provocative action, and to precipitate an acute attack of subtertian malaria when given in small doses.

(3) It has a particularly destructive action on the gametocytes of *P. falciparum*, and possibly even after a few doses may so affect the gametocyte that, although not apparently destroyed, it is unable to develop in the mosquito.

(4) The drug appears to be more valuable in treatment and to give rise to fewer toxic manifestations when combined with quinine.

(5) With daily doses exceeding 0·06 gramme definite toxic symptoms appear in a high percentage of cases, and in a few cases deaths have occurred apparently as the direct result of the drug. On the other hand, plasmoquine has been administered to patients suffering from acute pulmonary tubercle, pneumonia, heart disease, jaundice and typhoid fever without apparent ill effects. In many of the serious cases recorded the dose of plasmoquine has been very high, e.g., in three cases recorded by Manson-Bahr (1927), (1927) (*a*), the daily dosage was 0·12 gramme in two cases, and 0·08 gramme in one case.

(6) The toxic symptoms recorded have been cyanosis, now known to be due to methæmoglobinæmia, abdominal pain, giddiness, vomiting, collapse, jaundice, albuminuria, methæmoglobinuria. Of these cyanosis and abdominal pain appear to have been the most frequently observed.

In India carefully controlled experiments were carried out at the Malaria Treatment Centre, Kasauli, by Sinton and Bird (1928), on eighty-six patients suffering from chronic benign tertian malaria. The daily dose of plasmoquine was 0·08 gramme to 0·10 gramme, combined in half the cases with 1·25 gramme (20 grains) of quinine, and both the interrupted and continuous methods of treatment were used. The results were good as compared with the usual quinine treatment, but toxic symptoms were observed in a large proportion of the cases.

Further experiments were therefore carried out with doses of 0·06 gramme plasmoquine plus 1·25 gramme (20 grains) of quinine on one group, and with 0·04 gramme plasmoquine plus 20 grains of quinine on a second group of cases. In both groups the treatment was by the continuous method for twenty-one days. The results were published by Sinton, Smith and Pottinger (1930). They found that 0·06 gramme plasmoquine gave rise to a high percentage of toxic symptoms (64 per cent) when employed by the continuous method, but that 0·04 gramme plasmoquine in combination with 1·25 gramme quinine was a satisfactory method of treatment, in that pyrexia was quickly controlled. *P. vivax* disappeared rapidly from the peripheral blood. Toxic symptoms, which were mild, and quickly disappeared on stopping treatment, occurred in only 25 per cent of cases. Relapses were also reduced to 8 per cent as compared with 42 per cent among the quinine-treated cases used as controls.

From the facts contained in an interim report from the Malaria Treatment Centre, Kasauli, of January 6, 1929, it was considered that a daily dose of 0·04 gramme of plasmoquine plus 1·25 gramme (20 grains) of quinine continuously for twenty-one days, would be sufficiently safe to try out on a large scale in the treatment of benign tertian malaria in the Army in India.

The troops concerned in such a mass treatment consist of both British and Indians, the latter varying greatly in physique. In the follower class of Indian the physique is usually poor. Both groups are spread over a huge area of country in which the temperature, humidity and the periods and extent of mosquito breeding vary enormously. In many stations it is quite impossible during the malaria season to discriminate between fresh and relapse cases of malaria.

Any attempt to take into account the above factors by varying the dosage of plasmoquine according to the weight and physical condition of the patient and the period of year during which treatment was to be carried out, by using quinine treatment without plasmoquine in units, and by restricting the treatment to those in hill stations only, would introduce unnecessary complications, greatly restrict the number treated, and vitiate the object of the experiment, which was primarily to ascertain : (*a*) whether the treatment could be safely given to all classes of patients whatever their physique ; (*b*) whether toxic effects were observed more frequently in one or other group (British or Indian) ; (*c*) if toxic effects did occur, what was their nature, frequency and importance ; (*d*) was the treatment efficacious in preventing relapses?

It was therefore decided that no difference should be made in the dosage used for individual cases, and that any fresh attack within six months of completion of the treatment would have to be considered as a relapse. The figures so obtained would obviously be an unfair estimate of the effects of the treatment in preventing relapses, but if the percentage of so-called relapses remained *lower* than with the usual quinine treatment, for which carefully controlled figures are available from the work of Sinton at the Malaria Treatment Centre, Kasauli, the results obtained would be very definitely in favour of the combined plasmoquine and quinine treatment.

By entrusting the treatment to a large number of medical officers in different parts of India many individual results and opinions would be obtained, which collectively would be of value as to the utility of the treatment so far as the Army in India is concerned.

What was required actually was general information as regards the results of a mass experiment with one definite form of treatment obtained from physicians treating a large number of cases, rather than very careful scientific data collected by experienced research workers.

With this object in view sufficient plasmoquine to treat 4,000 cases was obtained through the courtesy of the Havero Trading Company, Calcutta, the agents for the I.G. Farbenindustrie Aktiengesellschaft, the makers of plasmoquine.

On April 25, 1929, the following circular was issued to D.Ds.M.S. of all Commands, and to the A.D.M.S. Burma District.

"An extract from the clinical report of the Officer-in-charge Malaria Treatment Centre, dated 6th January, 1929, is forwarded for information.

"Of the various methods of treatment of benign tertian malaria by plasmoquine and quinine, that detailed in the attached extract, i.e., 0·04 gramme plasmoquine and 20 grains of quinine per diem for twenty-one days, appears to have given the best results both in the prevention of relapses and in the avoidance of unpleasant symptoms.

"It is requested that a trial be given to this method of treatment in each Command.

"It is desired that in each Command certain officers should be selected by the Deputy Director of Medical Services, to undertake the treatment and to keep records of the cases treated. Available medical specialists will naturally be included among those selected, but other R.A.M.C. and I.M.S. officers, considered suitable, should also be selected, particularly in stations in which malaria is prevalent.

"A specimen form is attached which embraces all the points on which information will be desired by these Headquarters at the end of the year. This will be kept up as a register in book form by each officer administering the treatment. These will be forwarded to Army Headquarters on 31st March, 1930, along with a report by the medical officer which should give his opinion as regards the treatment, its results and any points of interest he may have noted.

"It will be noted that no distinction is made in the special form between relapses and fresh infections. If the medical officer concerned is able to give a reliable opinion on this subject, as may be possible in certain stations, the words relapse or fresh infection should be entered in the remarks column in red ink.

"In addition a brief report is required on the last day of each month stating the number placed on treatment and the occurrence of any toxic symptoms. This report should be rendered to the Director of Medical Services in India through the Deputy Director of Medical Services of the Command concerned or the Assistant Director of Medical Services, Burma District.

"In stations where a laboratory is situated the medical officer carrying out this treatment should work in close co-operation with the officer in charge of the laboratory, who should embody his results in a special report on 31st March, 1930.

"The treatment will be the same in all cases of benign tertian malaria, viz.: 1 tablet 0·02 gramme plasmoquine and grains x of quinine in the morning. One tablet 0·02 gramme plasmoquine and grains x of quinine in the evening.

"To be continued daily for twenty-one days.

"The morning treatment will usually be carried out in the presence of

the selected medical officer, and the evening treatment in the presence of an Assistant or Sub-Assistant Surgeon who has been instructed as to the importance of observing the onset of any toxic signs, particularly questioning the patient as to the presence of abdominal pain. This is frequently so mild that patients do not complain unless definitely asked. In no case will the treatment be administered unless a medical officer or an Assistant or Sub-Assistant Surgeon is present.

"It is probably unnecessary to retain patients in hospital longer than the usual period, and there is no objection to patients attending hospital for treatment. Should abdominal pain, etc., be observed, treatment should cease till the symptoms disappear, usually in two days, and then be commenced again and carried on until twenty-one days' total treatment has been completed.

"In cases of malignant tertian malaria the usual routine treatment by quinine will be carried out, but 0·04 gramme plasmoquine will be given daily for five days prior to the patient leaving hospital with a view to destroying any gametocytes in the patient's blood.

"The treatment in both benign and malignant tertian malaria will only be carried out in cases of malaria microscopically diagnosed.

"To enable the after history of patients to be followed up after change of station, all malaria case sheets of men treated with plasmoquine and quinine will be marked at the top with a large P in red ink. Should the patient be transferred later to another station and suffer from a relapse or relapses, the Officer Commanding the hospital concerned will notify the Officer Commanding the hospital in which the initial treatment was carried out of the occurrence and date of the relapses, so that the medical officer who carried out the initial treatment can enter the details in his register.

"It may be pointed out that the stations selected should not be restricted to non-malarial stations, with a view to the avoidance of reinfections. If the experiment is carried out on a sufficiently large scale, sufficient information as to the effects of treatment will be available, even though a certain amount of reinfection occurs. Treatment should be carried out on British and Indian troops."

From a study of the registers in which details of the cases were entered, it is obvious that the medical officers selected to carry out the treatment have shown great interest in the investigation and kept careful records. The results from the thirty-five hospitals concerned are summarized in Table I.

In all, 3,213 cases of benign tertian malaria commenced, and 3,187 cases completed their twenty-one days of plasmoquine and quinine. A number of other cases, although commencing treatment, did not complete it owing to the supply of plasmoquine giving out in the later stages of the investigation. These cases, along with a certain number of others treated after December 31, 1929, and the subtertian cases receiving the five days' plasmoquine treatment at the end of their normal quinine course, are not

TABLE I.

	British Cases										Indian Cases												British and Indian cases all Commands	
	Southern Command		Northern Command		Eastern Command		Western Command		All Commands		Southern Command		Northern Command		Eastern Command		Western Command		Burma		All Commands			
	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent
Commenced treatment	480	—	490	—	251	—	77	—	1,298	—	296	—	1,125	—	301	—	57	—	136	..	1,915	—	3,213	—
Completed treatment of 21 days	478	99·5	486	99·1	250	99·6	72	93·5	1,286	99·0	295	99·6	1,113	98·9	301	100	56	98·2	136	100	1,901	99·2	3,187	99·19
Treatment *temporarily* stopped	140	29·1	51	10·4	71	28·2	17	22·0	279	21·4	74	25·0	93	8·2	18	5·9	5	8·7	6	4·4	196	10·2	475	14·7
Treatment *permanently* stopped	2	0·41	4	0·08	1	0·39	4	5·19	11	0·8	1	0·33	11	0·9	0	0·0	1	1·7	0	0·0	13	0·67	24	0·74
Relapses ..	24	5·02	34	6·9	2	0·8	3	4·16	63	4·8	8	2·7	79	7·02	3	0·99	0	0·0	14	10·2	104	5·4	167	5·2
Abdominal pain	81	16·8	37	7·5	59	23·5	10	12·9	187	14·4	59	19·9	68	6·04	17	5·6	3	5·2	6	4·4	153	7·9	340	10·5
Cyanosis ..	29	6·04	12	2·4	5	1·9	10	12·9	56	4·3	4	1·3	8	0·71	1	0·33	0	0·0	0	0·0	13	0·67	69	2·1
Gastro-intestinal symptoms	18*	3·7	9	1·8	3	1·1	3	3·8	33	2·5	0	0·0	14	1·2	1	0·3	2	3·5	0	0·0	17	0·88	50	1·5
Collapse ..	1	0·2	0	0·0	0	0·0	0	0·0	1	0·07	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	1	0·03
Debility ..	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	2	0·17	0	0·0	0	0·0	0	0·0	2	0·1	2	0·06
Jaundice ..	1	0·2	1	0·2	0	0·0	0	0·0	2	0·1	2	0·67	2	0·1	0	0·0	0	0·0	0	0·0	4	0·2	6	0·18
Headache or dizziness	3	0·6	1	0·2	4	1·5	0	0 0	8	0·6	9	3·0	2	0·1	0	0·0	0	0·0	0	0·0	11	0·5	19	0·5
Palpitation	0	0·0	0	0·0	0	0·0	3	3·8	3	0·2	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	3	0.09
Bradycardia	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	3†	0·2	0	0·0	0	0·0	0	0·0	37	0·15	3	0·09
Albuminuria	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	5‡	0·44	0	0·0	0	0·0	0	0·0	5	0·26	5	0·15
Methæmo-globinuria	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	1	0·33	2	0·17	0	0·0	0	0·0	0	0·0	3	0·15	3	0·09
DEATHS ..	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	0	0·0	1	0·08	0	0·0	1	1·7	0	0·0	2	0·1	2	0·06

* Many probably not caused by plasmoquine. † All these in one hospital, treatment not withheld in two cases. ‡ All cases noted in one hospital.

included in the figures given in Table I, nor are they discussed in the report.

The twelve cases among British troops and the fourteen cases among Indian troops and followers whose treatment was stopped permanently are referred to in the notes on the various toxic symptoms which occurred.

Toxic Symptoms in General.

Treatment was temporarily withheld for varying periods of time, owing to the appearance of toxic symptoms in 21·4 per cent of the 1,298 British cases and 10·2 per cent of the 1,915 Indian cases. In the great majority these symptoms were never severe and frequently were not mentioned in the hospital registers after the first twenty to thirty cases. In the circular on the subject, the necessity for careful observation of the patient on the part of the medical officer had been emphasized, and it was stated that the patient was to be particularly questioned as to the presence of abdominal pain.

Many medical officers refer in their reports to this matter and state that the effect of suggestion on the patients, particularly as regards "colic," was very marked. Once patients and medical officers had gained confidence in the drug, which they had been warned should only be taken with great caution, complaints apparently became few or ceased altogether. That the medical staff carrying out the treatment must have been equally influenced by suggestion is quite obvious from a perusal of the registers, and several medical officers themselves refer to this in their reports.

More or less unfavourable opinions as regards toxicity were received from one or two hospitals. These are referred to later, but it may be stated that very few cases were treated in these hospitals. The larger the number of cases treated in a hospital, the more favourable appear to be the opinions expressed on the value of the treatment, and fewer toxic symptoms of real importance are noted.

For example, in one British Military Hospital, treating 111 cases, in 20 of the first 30 cases treatment was temporarily stopped owing to the appearance of toxic symptoms; few occurred later. In another, treatment was withheld in 15 of the first 22 cases, but in only 4 of the next 76.

The percentage of toxic symptoms recorded, such as abdominal pain, cyanosis, and digestive disturbance, is less among Indian than British cases, possibly due to the latter bringing mild symptoms to notice more frequently, and also to the dark skin of the Indian masking such symptoms as slight cyanosis.

In view of the fact that ninety-nine per cent of both British and Indian cases ultimately completed their twenty-one days' course of treatment, toxic symptoms cannot have been very severe in the great majority of the cases.

Glucose was stated in the reports from one or two hospitals to have been useful in the prevention and treatment of cyanosis, etc., but details

are not given of the cases to which it was administered. Alkalies also were found useful in the treatment of epigastric pains. Sinton and Bird (1928), on the other hand, were unable to find that either glucose or alkali, as a prophylactic measure, caused any decrease in the incidence of toxic symptoms.

Epigastric pain and colic have been observed by all authors with experience in the use of plasmoquine. The cause appears as yet to be unknown, although Manson-Bahr (1927) has suggested that the pains are due to the rapid decrease in the size of the spleen. It was noted that in some of the British cases in the present series medical officers referred to this symptom as a "cutting pain over the splenic area." Epigastric pain is recorded in 14·4 per cent British cases, and 7·9 per cent Indian cases. In the majority of instances it appears to have been slight, and to have disappeared completely after the cessation of treatment for a day or two.

One medical officer notes the fact that in thirteen of twenty-four cases, in which he withheld treatment on account of this symptom, only slight abdominal discomfort was present rather than actual pain, and that had the patients not been warned to report if they felt any pain, the symptom would probably have been overlooked. In addition pain, although recorded now and then among the later cases, occurred with nothing like the same frequency as among the earlier cases treated.

TABLE II.

British Group (data available in 95 cases)						Indian Group (data available in 63 cases)					
Day of treatment	No. of cases	Day of treatment	No. of cases	Day of treatment	No. of cases	Day of treatment	No of cases	Day of treatment	No. of cases	Day of treatment	No. of cases
1st	0	8th	11	15th	1	1st	0	8th	5	15th	2
2nd	2	9th	7	16th	4	2nd	11	9th	3	16th	3
3rd	0	10th	11	17th	4	3rd	1	10th	5	17th	1
4th	5	11th	1	18th	1	4th	3	11th	7	18th	1
5th	5	12th	8	19th	2	5th	0	12th	1	19th	5
6th	8	13th	4	20th	0	6th	5	13th	4	20th	1
7th	15	14th	6	21st	0	7th	2	14th	2	21st	1
	35		48		12		22		27		14

In a few instances pain was accompanied by vomiting and slight cyanosis. In certain cases, although disappearing after cessation of treatment, it recurred later in the course. Such cases were the exception. Several medical officers refer to the fact that pain occurred with less frequency when the drug was administered shortly after a meal. Many writers have found that epigastric pain occurs less frequently if a large draught of water is taken after the dose of plasmoquine. This point has not been mentioned in any of the reports received.

In one hospital it was considered that there were two kinds of abdominal pain.

The first appeared to be a splenitis occurring in the first week of treatment in cases with acutely or chronically enlarged spleens, or in the third week of treatment, usually due to the patient taking too much exercise.

The second was a true colic due to gastro-intestinal irritation, and occurring mainly in the second week of treatment, diarrhœa being a further stage of this irritation. An alkaline mixture was found to relieve the condition without it being necessary to stop the plasmoquine in the later stages of the experiment.

In two hospitals (109 cases) pain is not recorded at all, nor was treatment withheld on account of its presence.

Data giving the day of treatment on which pain was first noticed in a certain number of the British and Indian cases are given in Table II.

It will be seen that there does appear to be a definite cumulative action of the drug which becomes evident about the sixth day of treatment.

Cases showing symptoms in the early stages of treatment (first forty-eight hours) became less numerous as the cases treated increased in number.

The duration of the epigastric pain and the number of days during which treatment was withheld are shown in Table III.

TABLE III.

British Group (187 cases)				Indian Group (153 cases)			
Duration of pain in days	No. of days treatment withheld	Total cases		Duration of pain in days	No. of days treatment withheld	Total cases	
1	1	78		1	1	26	
1	2	12	53·4 per cent	1	2	22	34·6 per cent
1	3	10		1	3	4	
2	2	44		1	5	1	
2	3	4	26·7 per cent	2	2	41	
2	4	2		2	3	7	
3	3	16		2	4	1	33·3 per cent
3	4	3		2	5	1	
3	5	1	11·2 per cent	2	6	1	
3	8	1		3	3	12	
4	4	7		3	4	1	11·1 per cent
5	5	3		3	5	3	
6	6	1		3	6	1	
6	7	1	8·5 per cent	4	4	8	
8	8	1		4	6	1	
9	9	2		4	14	1	
13	13	1		5	5	4	
				5	7	1	
				5	8	1	
				6	6	4	
				6	7	1	20·9 per cent
				7	7	1	
				8	8	1	
				9	9	2	
				10	10	2	
				12	14	1	
				13	13	3	
				16	16	1	

In 79·1 per cent of the British group, and in 67·9 per cent of the Indian group, epigastric pain had disappeared after two days' cessation of treatment. Treatment was generally withheld for longer periods among the earlier cases treated than among the later cases.

Table IV shows the variation in the incidence of cases suffering from epigastric pain in different hospitals. It should be stated that the results of these hospitals have been specially selected to illustrate this point.

TABLE IV.

British Hospitals		Indian Hospitals	
Cases treated	Percentage with abdominal pain	Cases treated	Percentage with abdominal pain
147	3·4	89	0·0
147	5·4	20	0·0
147	5·4	106	1·8
180	6·1	301	2·6
41	2·4	112	3·5
111	34·2	126	29·3
91	30·7	64	23·4
91	26·3	49	20·4

It seems therefore obvious that severe pain, and pain of prolonged duration, is the exception rather than the rule, when 0·04 gramme plasmoquine is employed as a daily dose, and that the incidence of pain recorded in any series of cases must depend largely on confidence in the safety of the drug in the mind of both patient and physician. Cessation of treatment for a day or two was sufficient to clear up epigastric pain in the majority of cases, and as a rule this symptom did not recur.

It is noted that in the *Bulletin of the Institute for Medical Research*, Federated Malay States, No. 3, of 1929, Green (1929) states that out of fifty-six patients treated with a similar daily dose of plasmoquine as in the present series of cases, abdominal pains occurred in three only (5·4 per cent). In the series of 48 cases reported by Sinton, Smith and Pottinger (1930), there were 11 cases of "slight" abdominal pain (22·9 per cent), and Wallace (1928) treated over 500 coolies without encountering any severe toxic symptoms.

The occurrence of cyanosis was first recorded by Sioli in 1926, and along with epigastric pain has been noted since this date by practically all writers on the subject. In almost all cases in which it has been connected with severe symptoms—e.g., collapse, severe abdominal pain, albuminuria, etc.—the daily dose employed has been 0·06 gramme or more.

Fischer and Weise (1927) reported that after a daily dose of 0·03 gramme plasmoquine, methæmoglobin is formed in a concentration of 2·5 per cent. After doses of 0·08 to 0·1 gramme per day, the methæmoglobin reaches 8 to 12 per cent and cyanosis becomes apparent clinically. These authors

also state that "after cyanosis has once occurred no aggravation of the symptoms is caused by continuing to give the drug."

Fletcher and Kanagarayer (1927), and Fischer and Weise (1927), find that cyanosis becomes clinically evident on the fifth or sixth day of treatment.

Manson-Bahr (1927) found that the addition of quinine to plasmoquine was useful in preventing cyanosis.

Green (1929) observed no cases of cyanosis among his fifty-six cases receiving 0·04 gramme plasmoquine and 20 grains of quinine hydrochloride for ten to eleven days, the cases including Tamils, Chinese and Sikhs, but apparently no Europeans.

Sinton, Smith and Pottinger (1930) record one case of slight cyanosis (European) among forty-eight patients receiving a similar daily dose of plasmoquine and quinine for twenty-one days.

The usual indication of methæmoglobinæmia is that a blue tinge appears on the lips, gums, tongue and finger-nails, while the face sometimes assumes a slaty or grey-blue appearance.

In this series of cases, cyanosis is recorded as having appeared in 56 out of 1,298 British cases (4·3 per cent), and in 13 of 1915 Indian cases (0·67 per cent). The day of treatment on which this symptom was first observed is shown for thirty-seven British patients in the following table:—

TABLE V.—BRITISH.

Day of treatment		No. of cases
3rd	..	1
4th	..	1
5th	..	2
6th	..	3
7th	..	10
8th	..	4
9th	..	3
10th	..	1
11th	..	4
12th	..	1
15th	..	2
17th	..	1
18th	..	1
19th	..	2
20th	..	1
		37

In eighty per cent, therefore, the cyanosis became apparent on or after the seventh day. In one Indian case it was first noticed on the sixth day.

In 55·5 per cent British cases the symptoms cleared up in forty-eight hours, and in 70·3 per cent in seventy-two hours. Among the Indian cases the cyanosis in the main was also of short duration. The three Indian cases in which treatment was permanently stopped occurred in one hospital, and being the only instances of cyanosis noted were probably viewed with alarm. In the case which died cyanosis was accompanied by bilious vomiting and jaundice. This case is described later.

It is probable that owing to the dark skin of the Indian group cyanosis would have to be more marked in these cases before becoming noticeable than among British cases. The smaller incidence among the Indian group is probably due to this fact rather than to any difference in racial susceptibility. Fischer and Rheindorf (1928) state that "plasmoquine by-effects were specially observed amongst people belonging to the coloured races" (negroes and Malayans). Menk (1928) states that in Cuba it has been found that the Haitian negro cannot tolerate as large a dose of plasmoquine as other races.

TABLE VI.—THE DURATION OF CYANOSIS AND THE NUMBER OF DAYS ON WHICH TREATMENT WAS WITHHELD.

British Group			Indian Group		
Duration of cyanosis in days	No. of days treatment withheld	Total cases	Duration of cyanosis in days	No. of days treatment withheld	Total cases
1	1	15	1	1	2
1	2	3	1	2	1
1	3	1	2	2	1
2	2	7	2	3	2
2	3	4	2	4	1
3	3	4	5	5	1
3	4	2	7	8	1
4	4	3	Treatment permanently stopped		3
4	6	1			
4	10	1			
5	5	3	Death		1
6	6	1			
9	9	1			13
Treatment permanently stopped		8			
		54			

Muhlens (1927) states: "From numerous tropical countries, e.g., Vad and Mohile, Baermann and Smits report that plasmoquine (generally plasmoquine comp. is under consideration) is readily taken and well borne by coloured patients. There is little cyanosis." . . .

The last statement appears to be borne out in the present series of cases, as far as the Indian is concerned. Sinton (1930) has suggested that the Northern European may be more susceptible to the action of the drug than the inhabitants of Southern Europe and the tropics.

As in the case of epigastric pain, hospitals varied very much in the importance they attached to the slighter degree of cyanosis, and many of the cases are noted as "slight cyanosis, lips and finger-tips."

The 13 cases among Indian troops were restricted to 7 hospitals, treating between them 880 cases. In the remaining Indian military hospitals 1,035 cases were treated without a case of cyanosis being recorded, or treatment being withheld for this symptom.

When the incidence among the early and late cases in the series is compared it is obvious that in the British group mild cases must have been passed without notice in the later stages of the experiment.

In eight of the British cases (0·6 per cent) treatment was permanently stopped owing to the occurrence of cyanosis.

Case 1.—Cyanosis on tenth day marked in the face and finger-nails. Took four days to disappear; therefore treatment stopped.

Case 2.—Epigastric pain and slight cyanosis appeared on seventh day. Treatment withheld for three days, but symptoms reappeared after the first dose of plasmoquine; therefore treatment discontinued.

Case 3.—Cyanosis developed on ninth day, treatment stopped for three days. Recontinued treatment until sixteenth day when cyanosis reappeared. Plasmoquine was therefore stopped entirely.

Case 4.—Pallor and cyanosis on sixteenth day, treatment stopped.

Case 5.—Very cyanosed on ninth day, and as the patient was intensely anæmic, plasmoquine was stopped and the patient transferred to the hills.

Case 6.—Severe cyanosis on sixth day, lasted four days, so plasmoquine stopped.

Case 7.—Cyanosis and pain on sixth day, treatment withheld three days. On sixteenth day of treatment symptoms recurred, and plasmoquine stopped.

Case 8.—Cyanosis on eighth day. Reasons for complete cessation of plasmoquine not given.

In only two cases is dyspnœa noted along with cyanosis. As regards one case a medical officer (147 cases treated) states that in the "so called" cases of cyanosis, there was only one patient who complained of any subjective symptoms or showed any distress on exertion. The second case is stated to have had marked cyanosis of the lips, finger-nails, pinna of ears and shortness of breath. Toxic symptoms persisted, and treatment was withheld for nine days in this case.

In one hospital it was noted that a slight blueing of the lips was apparent in many of the patients on the last day of treatment, although cyanosis sufficient to withhold treatment had not appeared, and in another it is stated that many cases appeared to lose their marked pink complexion during the treatment, but yet could not be called cyanosed.

It may be concluded, therefore, that 0·04 gramme plasmoquine combined with quinine does in most cases, whether European or Indian, produce a methæmoglobinæmia which is insignificant in the majority of cases, and also that, as in the case of epigastric pain, the action of the drug is cumulative, visible effects occurring mainly after the sixth day of treatment.

The percentage of cases in which the cyanosis becomes obvious is small, 4·3 per cent in European and 0·67 per cent in Indian cases, and on cessation of treatment the symptom seldom recurs. In a certain small percentage of cases there does appear to be a definite individual idiosyncrasy to the action of the drug in regard to the occurrence of both epigastric

pain and cyanosis. That in the average mild case at least the continuance of treatment appears to do no harm, and in the majority of cases the methæmoglobinæmia does not increase with continuous treatment, seems proved by the fact that in 1,035 cases in the Indian military hospitals this symptom is not even noted. It is difficult to believe that among such a large number, mild cases which passed unnoticed owing to the dark skin of the patients did not occur.

Vomiting and diarrhœa, considered to be directly due to plasmoquine, do not appear to have been encountered by many authors, except as accompanying severe toxic symptoms. Sinton (1930) states, however, that *early* toxic symptoms may be ushered in by sudden severe vomiting, abdominal cramps, diarrhœa, jaundice, albuminuria, hæmoglobinuria, drowsiness and collapse, and records two cases in which the toxic symptoms resembled an attack of cholera.

In the present series symptoms of gastritis and intestinal irritation have been extremely few.

Among British cases vomiting without pain is recorded in thirteen. In thirteen further cases both pain and vomiting occurred. Twelve are from one hospital, and as in the majority the gastritis symptoms appear to have arisen in the first two days of treatment it is probable that the symptoms in most of these cases were due to malaria and not to the plasmoquine. In certain other hospitals a note occurs occasionally in the hospital register stating "vomiting occurred, but not due to plasmoquine." In ten British hospitals 530 cases were treated without a single case of gastritis or vomiting being noted.

Although the percentage of British cases with gastro-intestinal symptoms arising during the course of treatment amounts to 2·5, it is doubtful whether in a large proportion of the cases symptoms were not caused by other factors than the plasmoquine.

Diarrhœa is mentioned in ten cases, five of which were in the hospital mentioned above. In three cases it was accompanied by pain, in three pain, vomiting and diarrhœa occurred simultaneously. In one case vomiting and diarrhœa were present without pain, and in three diarrhœa was present without pain or vomiting. In fourteen British hospitals 835 cases completed treatment without a single case of diarrhœa being noted in any single series.

Details of a few cases in which plasmoquine was considered as responsible for the symptoms are given in Table VII.

The symptoms appear therefore to have been mild in nearly all. Three cases however appear to have been definitely susceptible. The first case completed the full course of twenty-one days' treatment, but pain and diarrhœa appeared on the sixth day, and lasted for four days. Treatment was recommenced, but pain, cyanosis and vomiting recurred on the fifteenth day. Treatment was withheld for two days, and the symptoms again recurred on the nineteenth day for two days, after which treatment was completed.

TABLE VII.—(BRITISH GROUP.)

Symptoms	Day of occurrence	Duration of symptoms in days	Days treatment withheld
Vomiting	3rd	1	1
,,	7th	2	2
Pain and vomiting	4th	2	2
,, ,,	6th	2	2
,, ,,	8th	2	2
,, ,,	9th	2	2
,, ,,	9th	1	1
,, ,,	8th	4	4
,, ,,	12th	2	2
Pain, vomiting and cyanosis	18th	6	6
Pain, vomiting and diarrhœa	?	3	3
Vomiting and diarrhœa	?	1	1
Diarrhœa	?	3	3

The second case had diarrhœa on the thirteenth day, which lasted two days. On continuation of treatment the diarrhœa recurred. Several attempts were made to continue the course, but, as diarrhœa always recurred, plasmoquine was finally stopped.

The third case suffered from gastritis, vomiting and diarrhœa on the sixth day. Treatment was stopped for two days. On the eleventh day of treatment a second attack occurred. Treatment was stopped for five days. On the seventeenth day plasmoquine was stopped completely, as it was not agreeing with the patient.

Two cases developed dysenteric symptoms, which in one were proved to be due to *E. histolytica*. In the other *E. histolytica* was not seen, nor were dysentery bacilli isolated.

Among eleven Indian military hospitals in which 1,237 patients were treated, no instance is recorded of treatment being stopped for either diarrhœa or vomiting, and there is no mention of these symptoms occurring.

Seventeen cases of gastro-intestinal disturbance were reported in five other hospitals. Details are given in Table VIII.

TABLE VIII.—(INDIAN GROUP).

Symptoms	Day of occurrence	Duration of symptoms in days	Days treatment withheld
Vomiting	5th	2	2
Pain and vomiting	16th	2	2
Pain and diarrhœa	8th	3	3
,, ,,	8th	3	3
,, ,,	8th	3	3
,, ,,	12th	2	2
,, ,,	16th	2	2
,, ,,	14th	3	3
,, ,,	11th	2	2
,, ,,	11th	2	2
,, ,,	11th	5	5
,, ,,	13th	2	2
,, ,,	16th	3	3
Pain in liver region and diarrhœa	16th	11	11
Pain and diarrhœa	15th	2	2
Pain and diarrhœa	18th	5	5
Diarrhœa	10th	6	6
Diarrhœa	11th	4	4

Two cases of dysentery occurred during the treatment and *B. flexner* was isolated. Treatment was in each case stopped for ten days and then resumed.

Gastritis appears therefore to have been a very rare symptom among Indian cases, and gastro-intestinal symptoms generally to have been of infrequent occurrence—0·88 per cent of all cases treated. In such cases as did arise, the symptoms were in the main of short duration.

The period of treatment during which the symptoms are likely first to occur appears to be from about the end of the first week onwards in both British and Indian patients.

There appear to have been no cases of collapse among the Indian troops treated. One case recorded among the British group occurred on the second day of treatment. The medical officer concerned did not consider the collapse as due to plasmoquine. Treatment was continued on the next day to the end of the course, without toxic symptoms intervening.

One case fainted on the eighth day of treatment, and one is described as being cold, clammy and sweating profusely on the second and third days after treatment commenced. In both cases treatment was continued after two days without any toxic manifestations and the medical officer considered that in neither case could the symptoms be definitely assigned to the plasmoquine.

Headache and giddiness appear also to have been very infrequent among both British and Indian troops. Three cases of headache and dizziness are recorded on the seventh, eleventh and sixteenth days. In each case treatment was withheld for two days. One case of dizziness occurred on the sixth day; treatment was restarted next day. There were two cases of headache and abdominal pain, treatment withheld two days; one case dizziness and vomiting on thirteenth day, symptoms lasted two days; one case of epigastric pain, headache and dizziness on the nineteenth day; treatment was recommenced in two days without any recurrence.

Fourteen Indian military hospitals (1,518 patients) record no instance of the occurrence of either symptom.

Five cases were observed in one hospital, four in a second and two in a third hospital.

Hospital (A).—Five cases of dizziness lasting in four cases for two days, and in one case for ten days.

Hospital (B).—Four cases, three of giddiness, two lasting for one day and one for two days, and one of headache lasting for one day.

Hospital (C).—Two cases, one of headache and slight albuminuria on the twentieth day, lasted two days. One of headache and tightness of chest lasted three days. This patient had only been treated for one day, therefore the symptoms could hardly have been due to plasmoquine.

Jaundice of a mild type occurred in two cases among the British group. In both cases treatment was stopped for five days, after which the patients completed the course.

There were four cases among the Indian group, of which one must have been almost negligible, as treatment was only stopped for one day. Of the remaining three cases, one, which was associated with methæmoglobinuria, occurred after the third day of treatment. The second case appears to have had a typical attack of blackwater fever, symptoms arising also after three days' treatment (0·12 gramme plasmoquine). Pyrexia, 104° F. at onset of attack, bilious vomiting, jaundice, pain in loins, methæmoglobinuria, tube casts, some red blood-corpuscles, and albumin in urine. Condition cleared up in seven days. Many subtertian cases of malaria and mixed cases of benign tertian and subtertian malaria were being treated in this hospital at the same time as this case occurred, and it appears possible that the symptoms may have been due to subtertian infection and not to the plasmoquine. The third case was similar to the above, and both are described later.

Cardiac irregularities sufficient to attract attention appear to have been almost non-existent.

Both tachycardia and bradycardia have been reported by various writers, and Eicholtz (1927) has shown that plasmoquine when administered in toxic doses to cats causes cardiac irregularity. Green (1929) as the result of very careful observations found that equally slow pulse-rates were found among patients treated with quinine only, and among patients after malarial paroxysms who had received neither quinine nor plasmoquine.

In only three hospitals was bradycardia or tachycardia noted.

In one hospital three cases of bradycardia were noted. In the first case treatment by plasmoquine was completely stopped, without any rise ensuing in the pulse-rate. In the other two cases treatment was not stopped, and the patients completed their course of treatment without any toxic symptoms appearing.

In a second hospital, palpitation was recorded in three cases. One case had cyanosis and palpitation; treatment was withheld for seven days. The second case had pain, cyanosis and palpitation on the fourteenth day; treatment was withheld for two days. The third had palpitation on the fourteenth day; treatment was stopped for two days.

In a third hospital, pain in the chest over the cardiac area was complained of by two patients, and in one of the cases was associated with cyanosis. Treatment was withheld for two and four days respectively. One case of tachycardia was also noted, but the withdrawal of plasmoquine did not relieve the condition.

Considering that over 3,000 cases of malaria received this treatment, the percentage of cardiac disturbance among the cases is negligible, and indeed appears to be less than would normally be expected in an equally large group of malaria cases receiving the usual course of quinine.

Excluding three cases in which methæmoglobinuria occurred, five cases of albuminuria are reported among the 3,000 odd cases treated. All of these cases occurred in one Indian military hospital (64 cases treated), and as it

was in this hospital that two of the cases of methæmoglobinuria occurred, it is obvious that special care was taken to examine the urine for albumin in all subsequent cases. One other hospital (103 cases treated) states that albumin was examined for, and not found, but accurate notes were not kept. It is probable that albuminuria *would* have been found if tests had been carefully carried out. On the other hand, the fact that over 3,000 patients completed full treatment without any symptoms suggesting to the physician that repeated and careful examinations of the urine for albumin were necessary, seems to exclude the possibility of plasmoquine in the dosage employed having any toxic action on renal tissue.

Of the five cases recorded, the first had albuminuria on the sixth day of treatment, which persisted for nine days, after which the course was completed. The second had albuminuria on the second day, which persisted two days, after which the course was completed. The third had albuminuria on the twentieth day, which lasted two days; the course was completed. The fourth had albuminuria and pyrexia on the sixth day; the course was stopped. The fifth had albuminuria on the 19th day, which lasted two days; the course was completed.

Sinton and Lal (1924) pointed out the great divergency in existing records as regards the incidence of albuminuria in malaria cases and discussed the various factors which would account for these differences. From their own investigations in India they found that 12·2 per cent of benign tertian cases of malaria had albumin in their urine prior to quinine treatment and 12·6 per cent during treatment.

Green (1929) found albumin in 26 per cent of cases treated with "plasmoquine compound" and in 20 per cent among quinine-treated cases. He considered that "plasmoquine comp." in the dose employed (0·04 gramme daily dose of plasmoquine) gave rise to no renal damage.

Major E. Richmond, R.A.M.C., has found at the Malaria Treatment Centre, Kasauli, that of thirty-two healthy British soldiers given ten grains of quinine daily for five days, albumin appeared in the urine of two cases, in one on the third day of test, and in the other on the fifth day.

Of forty-eight malaria convalescents treated with 0·03 gramme plasmoquine and twenty grains of quinine daily and tested for albumin four times a day on most days, fourteen, or 29·2 per cent, have shown albuminuria at some time or other. Whether the quinine, plasmoquine or malaria is responsible is not known at present. In the vast majority the albumin has been transient. Many of the cases are pursuing their ordinary duties, including football and hockey, and in no case has treatment been withheld on account of the presence of albumin.

Further work is being carried out on this subject, and it is only mentioned here in order to point out to medical officers that the presence of a certain quantity of albumin in the urine in malaria cases treated with plasmoquine and quinine is not normally an indication to withhold treatment. Fletcher and Kanagarayer (1927) state definitely that plasmoquine did not cause albuminuria in their series of cases.

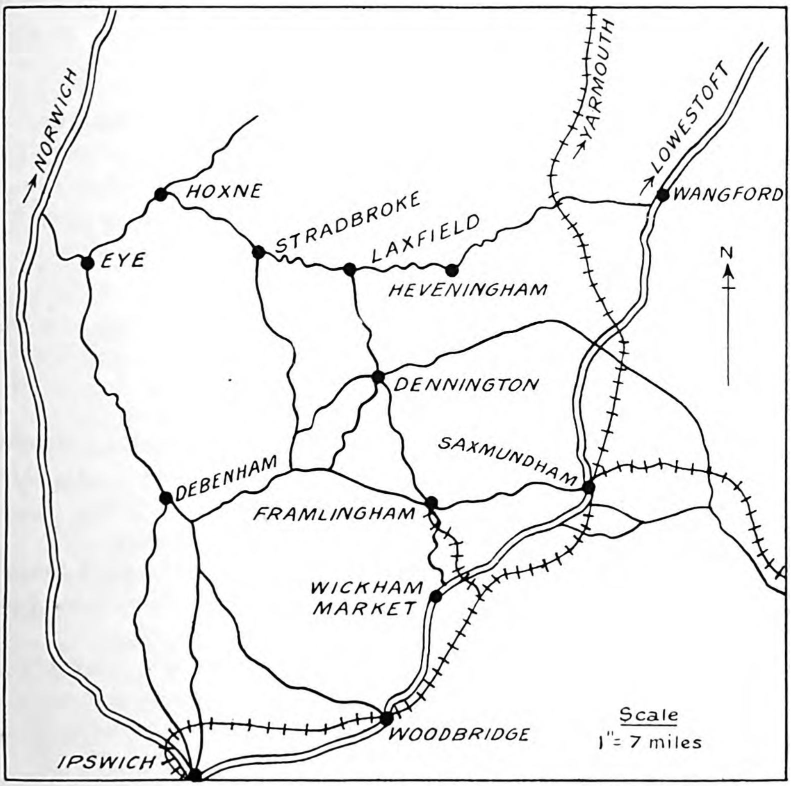
(*To be continued.*)

MEDICAL ARRANGEMENTS FOR A DIVISIONAL CONCENTRATION IN PEACE TIME.

By Colonel W. R. P. GOODWIN, D.S.O., K.H.P.

In 1930 the 4th Division concentrated in Suffolk for the purpose of carrying out Inter-Brigade and Divisional Exercises in the field. The peace stations of the 4th Division being Colchester, Shorncliffe, Dover, and Woolwich, and the concentration area being in Suffolk, special medical arrangements were necessary, and the following is an outline of the medical arrangements made.

The area occupied measured approximately eighteen miles by twelve miles. The sketch plan below shows the distances and the principal road and rail communications.



Four large standing camps were established, namely at Framlingham, Saxmundham, Wangford and Hoxne, with Divisional Headquarters at Framlingham. To visit these four camps by road from Divisional Headquarters entailed a round trip of approximately sixty miles.

The strength of troops at these camps was as follows: Framlingham, 899 all ranks; Saxmundham, 2,895 all ranks; Wangford, 2,789 all ranks; Hoxne, 2,683 all ranks.

The period of the concentration was from August 25 to September 19. Certain troops were, however, encamped in the area before and after these dates.

Three Field Companies, Royal Engineers, moved to the area on July 15 for the purpose of preparing camps, water supplies, etc., and were camped at Saxmundham, Wangford, and Hoxne respectively.

Advance parties of all units moved to the area on August 18.

Rear parties of all units remained in the area until September 25.

For convenience of description the medical arrangements may be grouped under the following headings:—

I. Arrangements for troops marching to and from the concentration area.
II. Arrangements for troops while in the concentration area.
III. Organization of the Divisional Field Ambulance.
IV. Collection and disposal of sick.
V. Medical statistics.
VI. Water supplies, sanitation, and conservancy.
VII. Supply of the required Royal Army Medical Corps personnel.

The 10th Infantry Brigade from Shorncliffe, the 12th Infantry Brigade from Dover, and the remaining troops of the 4th Division, other than those detailed under I. below, moved to and from the concentration area by train, and for these moves no special medical arrangements were made.

I.—Medical Arrangements for Troops Marching to and from the Concentration Area.

The following troops moved by route march:—

Cavalry. One regiment and an additional Squadron from Colchester.

Royal Artillery. One Field Brigade from Colchester, one Medium Brigade from Shoeburyness, one Light Brigade from Norwich.

Infantry. One Brigade (four Battalions) from Colchester.

For these marches the following medical arrangements were made:—

Cavalry. One medical officer and two privates, R.A.M.C. (nursing orderlies), accompanied, with one motor ambulance.

Field Brigade, R.A. One medical officer, one N.C.O. (dispenser), and two privates (nursing orderlies), accompanied, with one motor ambulance.

Medium Brigade, R.A. One medical officer and one private, R.A.M.C. (nursing orderly), accompanied, with one motor ambulance.

Light Brigade, R.A. Two privates, R.A.M.C. (nursing orderlies), accompanied.

Infantry Brigade. One medical officer, one N.C.O. (dispenser), and one private, R.A.M.C. (nursing orderly), accompanied, with one motor ambulance.

All the above R.A.M.C. personnel were, on the completion of the march, absorbed into the medical establishment of the Standing Camp Reception Stations, to be described later.

R.A.M.C. personnel were, during the march, attached for rations and accommodation to the units which they accompanied.

The Cavalry Regiment, each Royal Artillery Brigade, and each Infantry Battalion, took with it to the concentration area the following medical equipment:—

Field medical companion, 1; field surgical haversack, 1; water-bottle, medical, 1.

As regards evacuation of sick from the march, except in the case of the troops marching from Norwich, sick requiring evacuation were sent to the Military Hospital, Colchester, by road. Those from the Norwich troops to the Divisional Main Dressing Station at Framlingham.

Arrangements similar to those described above were made for the return march to peace stations on the conclusion of the concentration.

II.—Medical Arrangements for Troops while in the Concentration Area.

A. For Advance Troops.

It will be remembered that, before the main body of the division arrived in the area, three Field Companies, Royal Engineers, and advance parties of units were already on the ground. For these troops the following medical arrangements were made:—

One medical officer (major) was placed in charge of the three Field Companies at Saxmundham, Wangford, and Hoxne respectively, with his headquarters at Saxmundham. This officer had with him at Saxmundham one N.C.O., R.A.M.C. (dispenser), and one private (nursing orderly), while there was one private (nursing orderly) at each of the other two camps. This personnel was attached for rations and accommodation to the Field Company at the camp.

The medical officer had with him at Saxmundham one motor ambulance. By means of this vehicle he collected sick and evacuated to Colchester, thirty-eight miles away by road, such cases as required hospital treatment.

At each camp a marquee, G.S. double, was provided as a sick detention tent, with two circular tents for observation and medical inspection.

No patient was allowed to be detained longer than forty-eight hours.

Special arrangements for the evacuation of serious and urgent cases are described later under heading IV.

The R.A.M.C. personnel detailed above were, on the arrival in the area of the 11th Field Ambulance, absorbed into that unit.

The equipment for these Camp Medical Reception Stations is shown in Appendix I.

B. For Troops during the Actual Concentration Period.

At each of the four large standing camps the following R.A.M.C. establishment was provided :—

Medical officers, 2 ; sergeants or corporals (dispensers), 2 ; privates (nursing orderlies) 3.

The equipment was as shown in Appendix II.

One motor ambulance was stationed at each camp under the charge of the senior R.A.M.C. officer. These vehicles were borne on the strength of the 11th Field Ambulance.

Thus, a Camp Medical Reception Station was formed. Here the daily sick were brought and dealt with in the ordinary way. Patients could be "detained" in the reception station up to forty-eight hours ; if requiring admission they were sent to the Divisional Main Dressing Station at Framlingham. Men detained were rationed by their units.

The senior R.A.M.C. officer at each camp was appointed Camp S.M.O., and was responsible for the arrangements necessary for the inspection and disposal of sick and for medical and sanitary supervision.

The R.A.M.C. establishments at each standing camp were attached for rations and accommodation to units in accordance with instructions issued from Divisional Headquarters.

One batman for the R.A.M.C. Officers at each camp was provided under divisional arrangements.

III.—Organization of the Divisional Field Ambulance.

No. 11 Field Ambulance, modified to meet requirements, was formed for the concentration. This unit was utilized for establishing a Divisional Main Dressing Station to deal with the sick of the Division, and, in addition, took part in brigade and divisional exercises. The occasion therefore afforded an excellent opportunity for carrying out training, both technical and tactical.

An establishment, as detailed below, was authorized for the occasion :—

R.A.M.C.

	Medical Officers	9	
	Quartermaster	1	
	Warrant Officers	2	(1 R.S.M., 1 Q.M.S.)
	Staff Serjeants and Serjeants	7	
	Rank and File	84	
Total R.A.M.C. :	Officers	10	
	Rank and File	93	

Actually fourteen medical officers were allotted to the unit, of whom five attended for part of the period only.

R.A.S.C. (M.T.).

Serjeant..	1	
Rank and File	8	(for motor ambulances)

Artillery Transport Company.

Drivers	5	(for 5 lorries)

R.A.

Drivers for Horse Transport	9	(includes 1 N.C.O.)

The allotment within the field ambulance of this personnel was as follows :—

Headquarters.

R.A.M.C.:	Medical Officers	3	(includes 1 Lieut.-Colonel)
	Quartermaster	1	
	Warrant Officers	2	
	S/Sjts. and Sjts.	3	
	Rank and File	28	
R.A.S.C., M.T.:	Serjeant	1	
	Rank and File	8	(for motor ambulances)
Artillery Transport Company:	Drivers	3	(for motor lorries)
R.A.:	Drivers	5	(for horse transport)

Each Company "A" and "B."

R.A.M.C.:	Medical Officers	3
	S/Sjts. and Sjts.	2
	Rank and File	28
Artillery Transport Company		1
R.A.:	Drivers	2

Transport.

The transport allotted to the unit was as follows :—

M.T.	Motor ambulances	8		
	Lorries	5	3 for Headquarters 1 for each Company	For technical stores

It should be noted that two motor ambulances over and above war scale were allotted. This number was decided upon in view of requirements for the transportation of sick between standing camps and the main dressing station, and between the main dressing station and the military hospital at Colchester, the latter a distance of thirty-six miles.

					L.D. Horses
H.T.	Water carts	3	H.Q.	1	6
			Each Coy.	1	
	Maltese cart			1	1
	Officers' Mess cart			1	1
	Travelling kitchen			1	2
	Horsed ambulances			2	4

Equipment.

Medical.—As laid down in A.F.I.1248-4, modified to meet actual requirements.

Ordnance.—As laid down in A.F.G.1098-772, of May, 1929, modified to meet actual requirements, with the following additions :—

Tents, marquee, double	10
,, ,, hospital, small	6
Stretchers, ambulance	100
Wooden trestles	50
Tables, 6 foot	10
Forms, 6 foot	20

Stationery.

The necessary Army books and stationery were supplied by the Officer Commanding, Military Hospital, Colchester.

A typewriting machine was supplied under special authority from the War Office.

An advance party of the unit, consisting of one medical officer, the quartermaster, and twenty other ranks proceeded to Framlingham on August 25. This party pitched the tents and generally prepared the camp.

The move was carried out by road in a motor bus provided under arrangements made by the O.C., R.A.S.C.

The main body assembled at Framlingham on August 25, the move being carried out by train, and the Main Dressing Station was opened for the reception of sick at midday on August 26.

During Inter-Brigade and Divisional Exercises, when the Field Ambulance was carrying out tactical training, a party consisting of two medical officers, the quartermaster, and sixteen other ranks, was left at Framlingham to carry on the normal work of the Main Dressing Station.

One officer of the unit was appointed "Unit Damage Officer." This officer's duties were to obtain and co-ordinate reports of damages done by the unit, and forward them to assistant compensation officers, and further to assist compensation officers to investigate claims for damage attributed by landowners to the unit.

It will be noticed that no riding horses were provided. Officers were authorized to use private cars on official journeys and claim mileage allowance. Each officer using a private car in this way was obliged to keep a log book showing the journeys done.

The hired horses presented some difficulty, and at times created no little diversion by displaying a strong objection to the unfamiliar harness and vehicles. One of them gave vent to his feelings by proceeding to kick the Maltese cart to pieces, but before he had accomplished this he appeared to change his mind and broke up his harness instead. This animal was exchanged. The Royal Artillery drivers did splendid work under considerable difficulties.

IV.—Collection and Disposal of Sick.

As already described, a Medical Reception Station was established at each of the four large standing camps. Cases requiring evacuation were sent to the Divisional Main Dressing Station at Framlingham, each reception station having a motor ambulance attached to it for the purpose. Sick could be "detained" at the Camp Reception Station for a period not exceeding forty-eight hours.

No patient was allowed to remain in the Main Dressing Station longer than seventy-two hours.

The further disposal of patients requiring evacuation out of the divisional area was carried out as follows :—

(*a*) Urgent cases, whose removal to Colchester was deemed inadvisable, were sent to the East Suffolk and Ipswich Hospital, at Ipswich, by motor ambulance. The distance from Framlingham to Colchester is thirty-six miles ; the distance to Ipswich is eighteen miles.

(*b*) Infectious cases: major cases to the Borough Isolation Hospital

at Ipswich by motor ambulance; minor cases to the Military Hospital at Colchester.

Special arrangements for cases under (*a*) and (*b*) were made with the hospitals at Ipswich before the commencement of the concentration.

(*c*) Venereal cases were sent to the Royal Herbert Hospital, Woolwich.

(*d*) All other cases to the Military Hospital, Colchester, by rail or road, as circumstances demanded.

Patients admitted to the Main Dressing Station were dieted in the ordinary way by indenting for hospital supplies and accounting by diet sheets, etc.

V.—Medical Statistics.

The particulars of every patient admitted to the Main Dressing Station were entered in an admission and discharge book, which was kept up similarly to those at a military hospital.

The Officer Commanding the Field Ambulance was instructed to send to the Officer Commanding, Military Hospital, Colchester, on September 1, a return showing the particulars of all cases admitted to the Main Dressing Station up to midnight on August 31; further, on the closing of the Main Dressing Station, to send all admission and discharge books to the Military Hospital, Colchester.

For statistical purposes, all cases admitted to the main dressing station were shown as admissions to the Military Hospital, Colchester.

In this connection, the Deputy Director of Medical Services, Eastern Command, issued instructions to the effect that the strength of all units stationed in the Eastern Command would continue to be shown on the Army Form A. 31 of the hospital normally receiving their sick. The Military Hospital, Colchester, was to make the note referred to in paragraph 263 (*a*) Regulations for the Medical Services of the Army, against those units whose sick were admitted to that hospital and which were not normally on the strength of the East Anglian Area.

VI.—Water Supply, Sanitation and Conservancy.

Before the concentration commenced, the ground on which troops were to be camped and over which they were likely to carry out field operations, was reconnoitred by officers of the Divisional Headquarters Staff, Royal Engineers and Royal Army Medical Corps, and the question of water supplies was thoroughly explored.

The most serious difficulty was the supply of drinking water for the standing camp at Wangford; for this camp drinking water had to be brought in water lorries from Southwold, a distance of five miles.

In the case of the other three standing camps, water was piped to central water points.

As regards water for ablution, conditions varied considerably at the several camps. One camp was fortunate in being sited close to a stream of considerable size which afforded excellent bathing facilities. On the whole, however, no great difficulties presented themselves.

As regards details of the arrangements for drinking water supply, sanitation and conservancy, a copy of the Divisional Administrative Instructions on the subject is given in Appendix III, and will show the procedure which was carried out.

VII.—Supply of the required Royal Army Medical Corps Personnel.

The total number of personnel required was as follows :—

	Medical officers	Qr.-Mr.	Other ranks
Divisional Headquarters	2	—	2
11th Field Ambulance	14	1	93
Camp Duties	8	—	20
Totals	24	1	115

They were supplied as shown below :—

	Medical officers	Qr.-Mr.	Other ranks
Eastern Command [1]	18	1	84
Aldershot Command	2	—	—
Northern Command	1	—	—
Southern Command	1	—	24
Western Command	2	—	7
Totals	24	1	115
[1] East Anglian Area	5	1	16
Home Counties Area (West)	6	—	23
Home Counties Area (East)	5	—	29
London District	2	—	16

[1] Of the 14 Medical Officers shown against the 11th Field Ambulance, 5 were present for part of the period only.

APPENDIX I.

Equipment for each Medical Reception Station for advance troops :—

(i) *Medical—*

Medical Companion		1
Surgical Haversack		1
Regimental Medical Pannier		1 [1]
Camp Medicine Boxes	Pair	1 [1]
Medical Comforts Pannier		1 [1]
Thomas' Knee Splint Outfit		1
Water Bottles, Medical		2

[1] These items at the Medical Officer's Headquarters only.

The above equipment was supplied by the Officer Commanding the Military Hospital at Colchester, and was despatched in time to reach the camps on July 18.

(ii) *Ordnance—*

Tents, Marquee, G.S., complete	1
Tents, Circular single, complete	2
Stretchers, ambulance	2
Table—6-foot	1
Form—6-foot	1
Stools, camp	2
Bucket, latrine	1
Screen, latrine	1
Lamps, hurricane	2
Pan, bed, enamelled	1
Urinal, glass, blue	1
Blankets, G.S.	6
Bar, suspension, stretcher	1
Towels, hand	2
Warmers, stomach	1
Basins, washing, steel	1
Box, dressing	1

The above Ordnance equipment was drawn by the Officer Commanding the Field Company concerned.

(iii) *Army Books and Stationery*—

Admission and Discharge Book		1
Prescription Book		1
Memo. forms	Pad	1
Envelopes, small		100
Foolscap	Sheets	100
Pens, pencils and blotting paper.		

This was supplied by the Officer Commanding, Military Hospital, Colchester.

(iv) *R.A.S.C. Stores*—

Paraffin oil	Gallons	2

All the above equipment was handed over to the Officer Commanding 11th Field Ambulance, on the arrival of that unit at Framlingham.

APPENDIX II.

Equipment for each Medical Reception Station at standing camps :—

(i) *Medical*—

Medical Companion		1
Surgical Haversack		1
Regimental Medical Pannier		1
Camp Medicine Boxes	Pair	1
Field Fracture Box		1
Medical Comfort Pannier		1
Thomas' Knee splint		1
,, Arm ,,		1
Water Bottles, Medical		2
Case water test, sterilization		1

This equipment was supplied by the Officer Commanding, Military Hospital, Colchester.

(ii) *Ordnance*—

Tents, Marquee, G.S. Double, complete	2
One for Medical Inspection.	
One for Sick Detention.	
Tents, Circular, single	4
Two for sick observation.	
One for medical officer.	
One for medical other ranks.	
Axes, felling	1
Forms, dining tent	2
Kettles, camp	1
Buckets, latrine	2
Scoops, latrine	2
Screens, latrine	1
Sheets, ground	5
Panniers, G.S. (empty)	2
Shovels, G.S.	1
Stools, camp	2
Tables, camp	1
Tables, trestle, complete	2
Blankets, G.S.	12
Bars, suspension stretcher	2
Stretchers, ambulance	4
Towels, hand	6
Warmers, stomach	2
Cloths, tea	4
Basins, washing, steel, 14-inch	2
Brooms, bass, complete	1
Box, dressing	1
Can, oil, 5½ pints	1
Kettle, enamelled	1
Lamps, hurricane	4
Bed pan, enamelled	1
Tea pot	1
Pannikins	4
Saucepans, F.A. Nest	1
Stove, oil, Primus	1
Urinal, glass	2
Soap, yellow, bars	3
Latrine paper. Ream	1

This equipment was supplied and accounted for by the Officer Commanding, Military Hospital, Colchester.

(iii) *Army Books and Stationery—*

Admission and Discharge Book		1
Prescription Book		1
Sick Reports		500
Memo. forms	Pads	2
Envelopes, various sizes		300
Foolscap	Packet	1
A.F.G. 1033.		
A.F.G. 973 (equipment ledger)		1
Pencils, pens and blotting paper.		

(iv) *R.A.S.C. Stores—*

Paraffin oil	drum	1
Bleaching powder	lb.	1
Clarifying powder	lb.	1
Disinfectant, creosote	galls.	2

Supplied by the Officer Commanding, Military Hospital, Colchester.

APPENDIX III.

Water Supplies, Sanitation and Conservancy.

Attention is drawn to Field Service Regulations, vol. i, 1923, section 178 (F.S. Pocket Book, pp. 203-206).

(i) *Personnel.*—(*a*) Each Infantry Brigade and 2nd Medium Brigade, R.A., will detail one N.C.O., who has, if possible, passed a course of instruction at the Army School of Hygiene as Sanitary N.C.O. These N.C.O.s will be under the orders of the S.M.O. Camp. They will proceed to camp with the advance parties and will remain until dispersal has been completed.

(*b*) Regimental. In accordance with war establishments.

(ii) *Water.*—(F.S. Pocket Book, pp. 31-33).

(*a*) Drinking water (except where supplied from municipal pipes).

In standing camps. Will be chlorinated at the central water point by regimental water duty men, who will be placed at the disposal of the S.M.O. Camp for this purpose.

Away from standing camps. Will be chlorinated in regimental water carts if not drawn from chlorinated camp supply. This will be carried out by regimental water duty men, under the supervision of the Officer in Medical Charge of Troops.

Officers Commanding Brigades or independent units will ascertain from the Compensation Staff whether water in bivouacs is or is not from municipal piped supply.

(*b*) Before leaving their permanent stations, all units with carts, water tank, will ensure that these are clean and in good working order.

(*c*) Water bottles will be thoroughly cleansed with strong bleach solution once a week.

(iii) *Kitchens.*—Refuse will be incinerated. Sullage water will be disposed of by absorption pits with grease traps.

(iv) *Ablution Places.*—Waste water will be passed through grease traps into absorption pits.

(v) *Conservancy.*—(*a*) Latrines, Standing Camps, bucket latrines (F.S. Pocket Book, p. 205): Place three inches of one per cent. cresol solution in each bucket.

Bivouac areas. Shallow trench latrines. These will be completely covered with the excavated earth and marked with the letter "L" in stones before the unit leaves the bivouac.

N.B.—Cresol disinfectant solution (one per cent) is obtained by mixing 1½ ounces of cresol with one gallon of water.

(*b*) Urinals. By day, absorption pits in conservancy area. By night, receptacles (buckets or cresol drums, etc.), near the lines, emptied into absorption pits each morning.

(*c*) Camp refuse. Disposed of by incineration.

(*d*) Manure. Will be removed daily and close packed (F.S. Pocket Book, p. 204) while awaiting incineration or removal by contract.

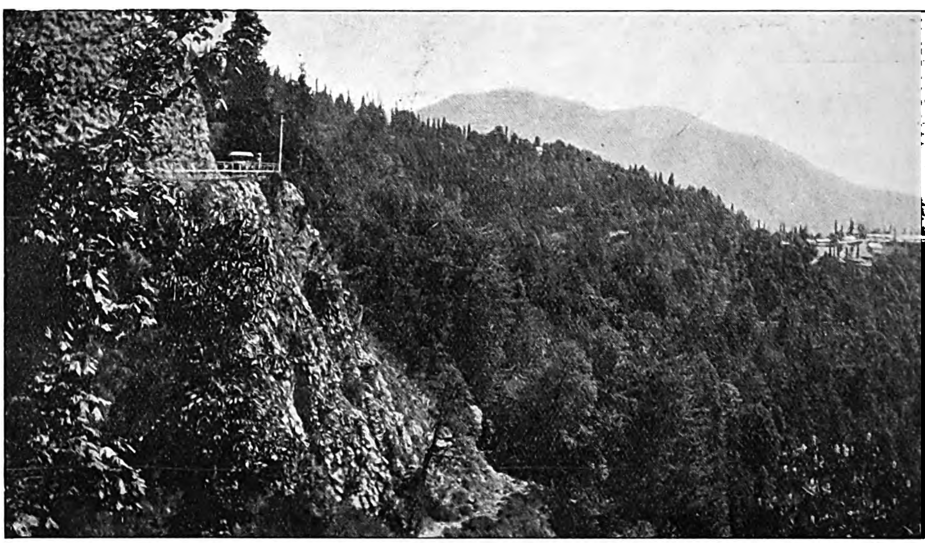
OUR STATION.

By OLA.

Our Station is in the Himalayas.

Astride the tumble of hills a massive outcrop, running north and south, is buttressed by a steep and narrow spur at a height of 9,500 feet. This spur sweeps downwards in a great crescent, first to the south and then to east, for a distance of ten miles, and finally loses itself in the gorge of a mighty river which rushes and roars on its journey to the thirsty plains below.

On their southern faces the outcrop and its spur are barren, rocky and very precipitous; but on their northern aspects they are covered with thick



Our Station is in the Himalayas.

forests and dense undergrowth, although here, too, they are exceedingly steep.

The ridge of the spur is, for the greater part of its length, very narrow. Here and there it broadens out to a hundred feet or so; but usually there is only a space of five feet on either side between you and an abyss.

Between contours 8,500 and 7,000, for a distance of three miles, Our Station perches precariously on this knife edge. The dairy is at the

---

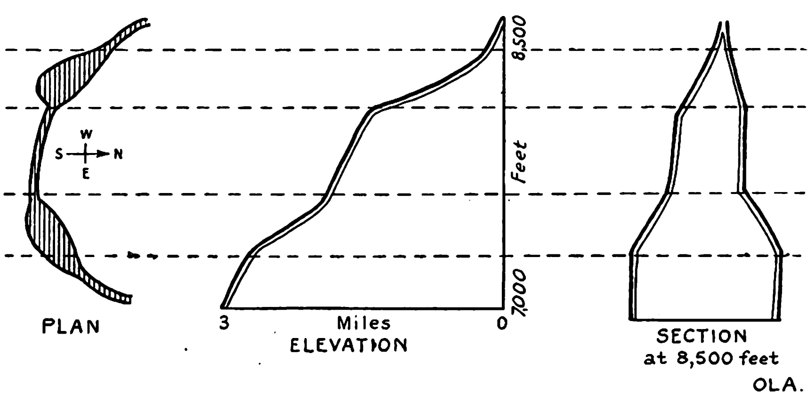
None of the persons depicted in this article exists outside the author's imagination.—Ola.

highest point and the rifle range at the lowest. Hill parties of the 22nd Cuirassiers and the Royal Horse Marines occupy the western half of the cantonment; similar detachments of the Royal Caterpillar Corps and 1st Bn. the Goomshire Regiment, are quartered in the eastern half; the officers' mess and bungalows, the hospital and the saddar bazar are situated midway.

The scenery in and around Our Station is both picturesque and grand. The lofty mountains, the beetling cliffs, the noble forests, the luxuriant undergrowth, the carpet of wild flowers—all these combine to form a kaleidoscope which ranges from sylvan charm to Alpine majesty; and to crown all the stern, inaccessible heights of the Hindu Kush raise their jagged, glistening peaks on the horizon far to the north.

It is as ridiculous to describe the Himalayas without a eulogy of the eternal snows, as it is absurd to write of India without a poetical mention of the Taj by moonlight.

Having, I hope, satisfied the reader of artistic temperament that Our Station is embowered in loveliness, it remains to placate the more practically-minded; to convey something to the man who prefers "Notes on Map Reading" to "Lalla Rookh."



Our Station.

Does that pacify him?

Of course it does not.

The man who gets down to bedrock, who insists on fundamentals, who confines his dealings to brass tacks, won't be put off with a mere diagram.

"Right!" says he (you notice the subtlety of it), "Right! but"—and here comes the cold douche—"what about your eternal snows, eh? I have often been in your station and I have never seen any snow at all, eternal or otherwise."

There is no sense in a remark like that. It is simply captiousness. It would be all to the good if steps were taken to exclude people of a certain temperament from such places as Killarney, Los Angeles, Millbank and

Our Station. Beauty is wasted on them. It is impossible to forget that, in this Journal, once upon a time, a lady described a visit which she had paid to the Taj by moonlight. She said that, in her opinion, it was a much over-rated spectacle. And the worst of it is that, supposing you could show the brass tack merchant the eternal snows diagrammatically, or even actually, he would just snort and say: "Gad! is that all?" But it's no use trying; the diagrammatic method is too difficult and the actual view is not for him; he won't come on the right day.

I do not desire to exaggerate. I do not wish to spoil my case by over-emphasis. Frankly, you cannot see the eternal snows all day or even every day; but it does not follow that you can never see them at all; I have seen them on several occasions. It is true that, as I sit at my desk now and face northwards, I can only see a strip of verandah, a patch of grass and a bed containing a few dejected marigolds. Thunder crashes overhead, echoing and re-echoing from every hillside within a radius of thirty miles. Torrents of rain and hail descend on the corrugated iron roof. The din is terrific. Down the sides of the great mountains innumerable streams must be cascading into the valleys below. From the beetling crags boulders, and similar weighty debris, must be hurtling into the depths beneath. In the noble forests the drip, drip, must be unceasing and very wet. Amongst the luxuriant undergrowth the humidity must be up to saturation point. Of these things I, at present, know nothing. I cannot get down to brass tacks; I can only surmise. The fact is, that Our Station is, literally speaking, in the clouds.

However, to-morrow—to-morrow I shall be able to see the eternal snows once again.

It has to be admitted that, although Our Station has few defects, still we could do with a little less rain. In some hill resorts the monsoon starts on June 15 and ends on September 15. According to the local gazetteer, and within the memory of the oldest inhabitant, these dates never vary by as much as twelve hours. This is quite unlike the meteorological conditions in Our Station.

When you arrive in April you get the Easter rain, hail and snow.

In May the "chhota bursat" comes along, causing you to wonder what the "burra bursat" will be like.

From the end of June until mid-September the monsoon wraps Our Station in its clammy folds; and in October or November, when your period of cold storage expires, you will be lucky if you get away without a sprinkling of the pre-Christmas rain, hail and snow.

Still—better the damp without than the ague within.

"Bless my soul!" exclaims the brasstacker—"I'd sooner be in Manchester." And I too—though that is very much a matter of opinion; and perhaps the above picture is too watery; you must not conclude that in Our Station rain, hail and snow fall continuously. As a rule precipita-

tion occurs only on alternate days, and then usually only from 11 a.m. to 3 p.m.; so, you see, the fine intervals are comparatively frequent and lengthy. Again—this sort of thing does not happen every year; indeed, in Our Station the chief characteristic of the weather is its irregularity—

The Mall.

a great point in these days when everybody demands, above all things, the factor of change. Even in up-to-date Manchester the weather does not display this redeeming feature; and never by any chance can you see the eternal snows from the steps of the Corn Exchange. That is a fact which might well be nailed to the counter—using a brass tack, of course.

In Our Station it is wise to move about on foot because, if you ride, you are compelled to return by the same route as you set out. There is

only one street or road, the Mall, and it runs down the very summit of the ridge. The houses lie close up on each side of the Mall, as in Nowshera or Long Melford; or, better still, as they do in the "ribbon building" along the new arterial motor roads at home. The bungalows and barrack blocks cannot be arranged in offshoots set back from this unique highway. As it is, there is nothing but space behind them. From their back doors the hillsides fall away in declivities which none but the monkeys can successfully negotiate.

This is a boon to the keen clinician, for small boys and girls delight in pushing each other over the khud with the object of seeing how often it can be done without serious injury. As a result fractures, dislocations and more or less serious abrasions are fairly common.

It is also a blessing to the energetic sanitarian, for the steep slopes—especially on their northern, wooded faces—form convenient rubbish dumps for the British inhabitants and ideal open-air latrines for the natives. To quote Infantry Training—"Woods provide the most obvious cover from view." If you are a sanitarian don your heavy ammunition boots, take up your long khud stick and spend an hour or two forcing your way through the dense undergrowth on the hillsides. You will be surprised at the sights, sounds, objects and smells which you will encounter. But, if you are not a sanitarian, keep away.

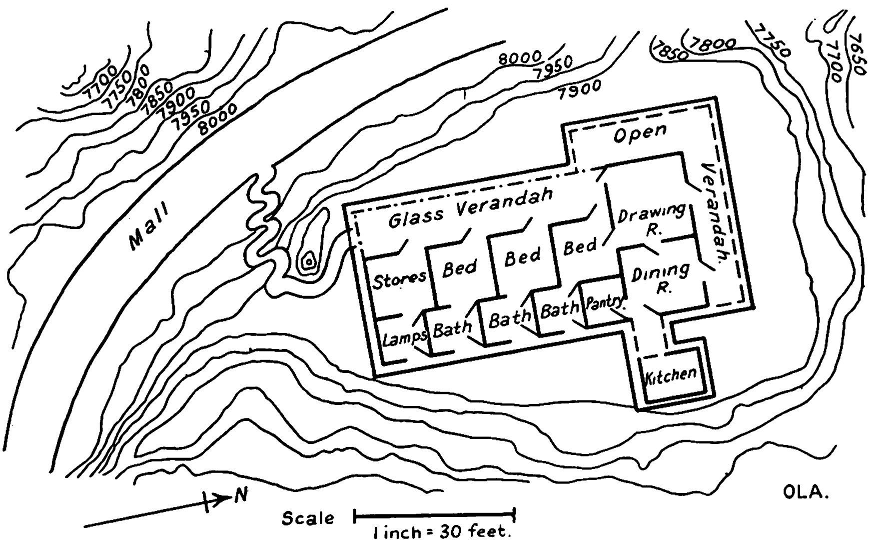
There are one or two entrancing forest paths running below the ridge. These are cut through virgin jungle, and in places their passage requires the exercise of care and deliberation. The æsthete should explore them in the fine weather intervals. He will find much to charm the eye and please the ear—magnificent trees, beautiful wild flowers, many strange and lovely birds, headed by the golden oriole, and gorgeous butterflies in profusion. But the conscientious M.O. should wander through the forest after a particularly heavy fall of rain, when he will discover that the paths and glades have held up all the empty salmon and sardine tins, discarded boots and shoes, broken bottles and dilapidated topis of a month's accumulation and carelessness. While he is contemplating the sodden mess he would do well not to lose himself in an ecstasy of professional inspiration and delight: an adder, sunning itself on the ruins of a perambulator, is watching him with more interest than friendliness.

These paths are maintained by the Forest Department for the carriage of cut wood and for inspection purposes; but they also connect up a few ledges which cling to the hillsides. The smaller ledges are always decorated with one type of ornamentation—a latrine-incinerator group; a sort of sealed-pattern "*Architecture, projections, Himalayan, for the adornment of.*" It is curious, or perhaps significant, that it is from these ledges that the finest views are to be obtained—a fact which is much appreciated by the conservancy stokers in charge of the crematoria. These poor fellows lead a hard life; small pay and long hours, wet or fine. It is

pleasant to reflect how thoughtfully and gracefully they have been compensated by the planners and builders of Our Station.

The bigger ledges support a few isolated bungalows and married quarters, the mutton market, the R.C. church and the civil police station.

There are several types of officers' bungalows, but all have two features in common: firstly, simplicity of design, in the well-known Koi Hai style; and secondly, corrugated iron roofs of the Shor Karna pattern. Here is the plan of the senior married officer's bungalow.



Plan of Flagstaff House.

The ground plan might be seen from an aeroplane; but from any other vantage point the bungalow is hidden by tall trees and dense vegetation. From the road one chimney pot can be detected. On the north aspect a few trees have been cut down in order to obtain a view of the snows —when a view is available—and, were it not for this opening, the building might well be called "Purdah Villa."

Note: (1) The rocky winding approach; a difficult obstacle after nightfall.

(2) The long glass verandah. If you are in this verandah when the monsoon clouds are rolling along outside, you feel as if you are in a Pullman car on the West Highland Railway. The noise made by the rain and hail on the roof heightens the illusion.

(3) The facilities afforded to Khansamahji for getting rid of greasy water and potato peelings with expedition and despatch.

A word of warning, in case you should ever have the good fortune to be posted to Our Station. It concerns furnishing, and is a good example of the evils of dual control.

The officers' bungalows—which are Government quarters—are reasonably well furnished on hire terms by the barrack-master, M.E.S. But M.E.S. furniture does not include utensils e.i. and g.i.: these are an Ordnance supply, held on charge by the S.S.O. They can only be issued to "other ranks"; officers cannot obtain them by hire, or otherwise. So, if you arrive as a greenhorn in Our Station, you will find that you have brought some furniture which you do not want, and are deficient of ironmongery which you must have.

You are issued with a table, a chair and a bed, on payment; but neither love nor money can procure a bath, a basin or a jug.

You may rest your body, but you may not wash it.

You then arrange to hire privately the necessary utensils from the nearest big cantonment, Likhnabad, twenty miles away by mountain road. This takes time. Following a reminder or two, the articles may turn up in from seven to ten days. By then you are somewhat grimy.

Married quarters, like officers' bungalows, are also of different types—or, rather, classes; but in this case the variations are personal rather than architectural; they depend more on opinion than on design, thus:—

	Occupant.		
Class.	(a) *Wife of L/Cpl., British Infantry. Six children*	(b) *Wife of Conductor, I.A.O.C., Past Grand Master of Lodge Himalayan Rainbow*	(c) *Anybody's wife. Silk Stockings. Lipstick. No children. Favourite author, M. Stopes*
3rd	Bad.	Miserable.	Very inferior.
2nd	Fair.	Tolerable.	Doubtful.
1st	Good (common).	Desirable (uncommon).	Very superior (extremely rare).

Later on we shall have the pleasure of meeting the inmates of some of these quarters.

The mutton market is no different from other markets of the kind, save in one respect; it is the only market in which you can purchase something to eat. There is a pork market; but, in a household governed by strict Mussulman servants, it is well to ignore its existence. There is also a meat market, and occasionally we buy a piece of beef. However, although you may take a horse to the water, you cannot make him drink; and although you may buy beef, it does not follow that you can eat it. In Our Station we do not eat beef for the same reason that we do not eat biltong or pemmican; our powers of mastication and digestion are not what they were in 1930 B.C. Still, it is comforting to see a slice of roast beef on one's plate; it is a reminder—if a poor one—of Old England.

The R.C church stands on a ledge which commands a wonderful view. It is a fine solid building with an attractive and well-appointed interior and, were you disposed to be critical, you might aver that this is *the only* building in Our Station. Some there are who point out that the church does not stand within the cantonment boundary; but whatever effect this may have had, it is quite certain that the bulk of expenditure on this substantial exterior and handsome interior was not made chargeable to public funds. The R.C. community has to be congratulated, therefore, on this practical proof of its piety and devotion.

The priest-in-charge is a Yorkshireman, tall and slim, and with a flicker of a smile which contains more jollity than a broad grin or a loud guffaw. Father Francis Mary never says: "Ba goom, it's a champion do," or "Yond's a caution"—like Mr. Oakroyd in "The Good Companions"—but assuredly he knows and appreciates what these expressions mean.

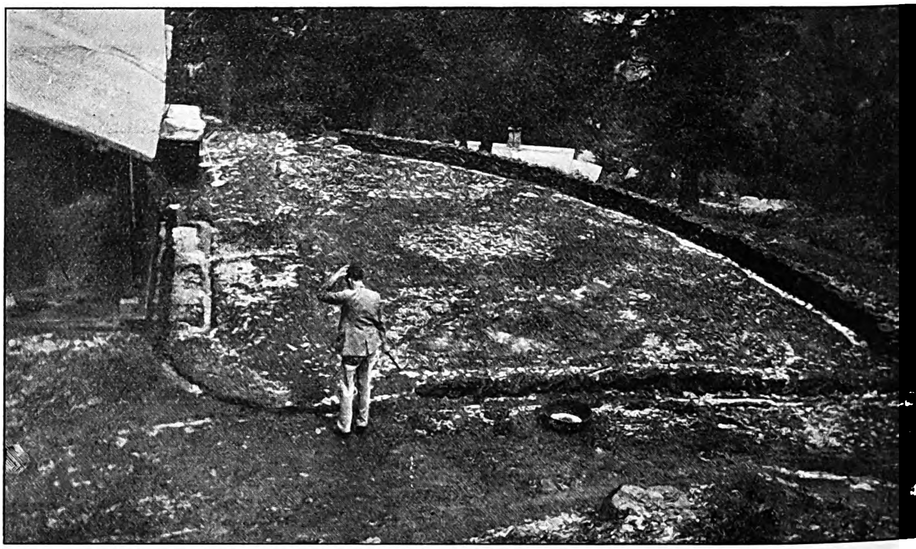
Admiration of, and respect for the worthy father forbid one from making more than a passing reference to his defects, i.e., to his dogs. They are not on the ecclesiastical, or any other, register. One of them is a proper tyke: the most impudent and inveterate thief in the world; and he seems to have earned perpetual absolution by showing a cunning sense of discrimination. He confines his depredations to the larders of the heretics. To do this sort of thing under the eye, and even protection, of the church is sheer persecution and bigotry, amounting to violation of religious tolerance—as we often protest to the owner of the culprit. Father Francis Mary merely smiles and replies: "'Tis nowt, laad. Denying a crust of bread to the poor? For shame!" the while the tyke is choking himself over the last chicken bone.

The civil police station is a trim little building standing in a tiny cultivated compound. Perhaps the latter should be called a garden, but definition is difficult. Cosmos grows side by side with cabbage, antirrhinum is mixed with artichoke, marigold mates with vegetable marrow, Indian corn and peas and beans alternate with tall daisies, hollyhocks and sunflowers; and yet everything is neat, tidy, and marvellously compact. The narrow paths are picked out in stones which are whitewashed every morning; and one set of such stones, at the entrance, spells the word "Welcome."

The presiding genius of this institution is a big burly havildar who rejoices in the name of the "Ogpu Sahib." He is very proud of this title. I believe he thinks it means "King of the Flowers," or something of the sort, as we are always extolling his horticultural prowess. And, indeed, he deserves all the praise he gets, for in this matter he succeeds where everybody else fails. In Our Station gardening is absolutely heart-breaking: rain, hail, ants, birds, monkeys, donkeys—

But why pursue the long, depressing catalogue? Let us forget our disappointments, and travail unrewarded, in contemplation of the Ogpu Sahib's handiwork. Why—the man could produce bread fruit out of a stone! When you ask him how he does it, he points to the swallows' nests under the eaves and says: "Angrezi qismat" ("English luck")—and what is more, he believes it.

I do wish the swallows would come and live with me.



The garden after hail.

The biggest ledge of all has been enlarged by digging out and buttressing. An immense amount of labour was expended on this work; but it was well worth it, for the place now holds a miniature football ground and four tennis courts. Occasionally one of these courts is washed down the khud, but, Phœnix-like, it reappears in due course.

(*To be continued.*)

THE ARMY'S MILK SUPPLY.

By Lieutenant W. B. V. GATES, M.B.E.,
Royal Army Service Corps (R. of O.).

Cow's milk, although intended by Nature for the calf, has from time immemorial found its place in the dietary of the nations.

According to authorities, the domestication of cattle occurred some 6,000 to 10,000 years ago. From these early days up to the present time the cow has continued to be a faithful servant of man. The cow was worshipped in Babylonia and Egypt about 2,000 B.C.; Hathor, the goddess who watched over the fertility of the land, was depicted as one.

The soldiers of Jenghiz Khan, the Mongol emperor who conquered Asia and a large part of Europe in the thirteenth century, carried dried milk as part of their rations.

Milk products found also an important place in the dietary of the Vikings during their extensive sea voyages in Northern Europe, and even across the Atlantic.

The first settlers in the New World—the Pilgrim Fathers—made the mistake of not taking cattle with them, and as a result of the absence of milk, the death rate, particularly amongst the children, was extremely high. In fact, nearly fifty per cent of the "Mayflower" emigrants died during the first winter, including every child under two years of age. This mistake was, however, speedily realized and rectified by the inclusion of milch cows in all further expeditions.

History teaches us, therefore, that milk has from the earliest times been regarded as a food of high nutritive value. This is borne out by its analysis.

Table I.—Analysis of Milk. (Droop-Richmond.)

Water	87·34	per cent.
Fat	3·75	,,
Milk sugar	4·70	,,
Proteins	3·40	,,
Ash	0·75	,,
Other constituents	0·06	,,
	100·00	per cent.
Calory value per ounce	17	

The high water content should be noted, as it is a fact of considerable significance when one thinks of the time, energy and expense involved in the transportation of the thousands of tons of water present in a day's consumption of liquid and condensed milk.

Milk, as in the past, forms part of the daily ration of the soldier, and in view of its nutritive value rightly so. It is the question of the means of coping with the supply of this commodity with which we are immediately concerned, for it must not be forgotten that of all forms of food, milk, being

the ideal medium for bacterial growth, ranks first as the most perishable and the most liable to spread disease through contamination.

The cow in the first place may, and in fact often does, contaminate its milk with the germs of the tuberculosis from which it is itself suffering, while during the period intervening between leaving the cow and its consumption a hundred chances of infection present themselves—dirty receptacles, wind-borne particles, flies and other insects, etc. Cows are extremely prone to tuberculosis, and it is stated that at least 2,000 infants die yearly from this scourge contracted from raw milk. As to the huge number who drag through a sickly childhood to become further progenitors of similar unhappy creatures nothing is said. Other diseases, such as diphtheria, scarlet fever, undulant fever, etc., have repeatedly been spread by contaminated milk; only last year several persons died in Brighton from a milk epidemic.

In any consideration of the Army's milk supply, particular attention must therefore be paid to the form in which this highly nutritious but potentially dangerous food is to be supplied.

In common with other supplies in general, the provision of milk must of necessity fall into two main categories: (1) supply at home; (2) supply abroad. And in both cases we must distinguish between peace and war conditions.

At home, in time of peace, little difficulty is experienced in obtaining supplies in barracks at any rate, raw milk from neighbouring farms and creameries or condensed milk being used. In summer raw milk not infrequently turns sour, and occasionally the supply is deficient. Condensed milk, on the other hand, cannot be regarded as favourably from the standpoint of nutritive value, owing to the long heat treatment undergone during manufacture, which affects its vitamin content and destroys part of its mineral salts.

During training periods, in which conditions most nearly approximate to those experienced on active service, the use of condensed milk becomes general for obvious reasons.

The factors of weight and ease of distribution play the predominating part in the choice of a milk for military use, and up to the present, condensed milk, because of the reduction in water content, coupled of course with its keeping powers and packing, has proved the most suitable for this purpose.

During the war, owing to the concentration of large numbers of men in camps, often somewhat inaccessibly located, condensed milk was used for the major part during the training period in this country. In recent years pasteurization has greatly improved the keeping quality of raw milk, while the use of rail and road tankers has facilitated its distribution. It, however, presents many handling difficulties even after arrival in camp, so that the use of small tins of preserved milk of one sort or another will in all probability again be resorted to in the future under similar circumstances.

Abroad, both in peace and war, local supplies of milk can rarely be depended upon. In the East, quite apart from any question of sufficiency of supply, local milk is rarely of good quality, while the danger of contamination is such as to preclude its universal use. This applies in a greater or less degree to the majority of foreign stations or likely overseas theatres of war, so that the use of a safe milk in compact form becomes essential. The two forms which are available at present are condensed milk and the more recent discovery, powdered milk.

TABLE II.—ANALYSIS OF CONDENSED MILK (UNSWEETENED). (H. E. COX.)

Water	66·18 per cent.		
Milk solids	33·82 ,,		
Fat		9·28	per cent.
Lactose		13·33	,,
Protein		9·16	,,
Ash		2·05	,,
	100·00		
Calory value per ounce	48		

Condensed milk is prepared by first pasteurizing raw milk by holding it at a temperature of 145° to 150° F. for half an hour, and then evaporating it in a vacuum pan for some two or three hours at a temperature of 130° to 140° F. After being poured into tins, it is sterilized at a temperature of about 230° F.

Authoritative investigations of this process have shown that the long heat treatment, although effective in preserving the milk, is partially destructive of the vitamins and mineral salts. Recent researches have shown that diets devoid of vitamins and essential salts lead to complex diseases such as scurvy, rickets, beri-beri, etc., so that the form of heat treatment used in producing a condensed milk for military use is seen to be of paramount importance.

In the light of present-day knowledge, condensed milk, although satisfying many of the requirements of active service conditions, is known to possess other weaknesses quite apart from the question of vitamin and mineral deficiencies, which render it far from being the ideal form of preserved milk for military purposes.

Although sound tins present milk in a convenient form which is fairly sterile, the danger of contamination, after the tin is once pierced, by flies and dust remains, owing to the fact that the product is, like ordinary raw milk, still liquid, and that the tin, once opened, cannot be effectually closed.

Who is there who, having been in the East, has not been nauseated to find on visiting the cook-house (an unwise thing to do, but essential at times), a tin of condensed milk which has been pierced and part of its contents used, standing on the table black with flies attracted to the liquid exuding from the puncture made for pouring out?

Again there is always the danger of finding one's supplies blown or putrid owing to damage to tins during transit. The period during which condensed milk will keep even when delivered in a sound condition is not really sufficiently long for overseas campaigns, and having once passed its warranty, it cannot, even in an emergency, be used with safety.

From the point of view of nutritive value a comparison of the analysis of condensed milk given in Table II and that of milk powders (Table III) is of interest. Whereas the fat content of condensed milk is only 9·28 per cent, that of the milk powders is 27·3 per cent and 28·2 per cent, while the calory value is 48 as against 150 and 152.

These data are of great significance, for the problem of food supply in modern warfare is that of providing the maximum calory value per pound of foodstuffs transported. The use of condensed milk, apart from involving the uneconomic transportation of sixty-five per cent of useless water, is thus seen to be extremely defective also in regard to this important desideratum.

We will now turn to a consideration of the more modern and alternative form of preserved milk, namely milk powder, of which there are two main varieties.

The following are analyses of the powders in their dry form (not reconstituted); they are only general and will in practice be found to vary according to the composition of the original milk :—

TABLE III.—ANALYSES OF MILK POWDERS.

	(1)	(2)
Moisture	2·5 per cent.	1·5 per cent.
Fat	27·3 ,,	28·2 ,,
Proteins	26·6 ,,	26·7 ,,
Lactose	37·6 ,,	37·9 ,,
Mineral matter	6·0 ,,	5·7 ,,
	100·00 per cent.	100·00 per cent.
Calorie value per ounce	150	152

Milk powders are made by drying milk, either full cream, half cream, or separated, thereby removing all but two to three per cent of the natural water content of the milk.

In recent years the manufacture of these products has reached a high standard of perfection and the powers that be are for various reasons, which are gone into fully below, turning more and more to this form of milk for overseas and active service use.

The methods of powdering milk may be broadly divided into two classes: (1) Roller methods; (2) spray methods.

(1) ROLLER METHODS.

Milk specially chosen for its cleanliness and freedom from bacteria is brought into the creamery from neighbouring farms as soon as possible after milking, and is passed through a centrifugal cleaner which removes the

natural slime of the milk. It is then run on to twin steel rollers internally steam heated and revolving in opposite directions. The milk dries on the rollers in the form of a film, is scraped off by tangential knives and falls as a powder, which is sifted and packed in air-tight tins.

In the modern type of roller machines the milk is only heated for two to three seconds at a temperature of 98° C., thereby ensuring a full conservation of the vitamins and mineral salts, while yielding at the same time bacteriological sterility. This feature, a result of the short heat treatment, particularly commends this process of powdering.

The curds formed in the stomach by roller powder are soluble and finely divided and therefore far more easily digested than those of raw milk or spray process powders which set in heavy, turgid clots. This fact is of no little significance when the body of the soldier is considered as a work-performing machine having a limited energy output, the conservation of which we are at such pains to ensure in other directions by fatigue-reducing expedients, such as lighter clothing and equipment, etc.

In the hospitals where the placing of a minimum strain on the digestion is an even more necessary precaution in order to conserve lowered vitality, the use of roller process powder is obviously of advantage, not only because of its digestibility, but because of its freedom from pathogenic organisms.

(2) Spray Methods.

In these methods the milk is first strained, then pasteurized for half an hour at 145° to 150° F. and subsequently fed into vacuum pans where it is evaporated to the consistency of condensed milk. It is then sprayed with a blast of hot air at about 180° to 190° F. in special chambers. This reduces the milk to a powder which falls to the bottom of the chamber, from whence it is removed and sifted.

Spray powder, although subjected to this long heat treatment, which is not desirable from the point of view of vitamin preservation, is not so sterile as roller powder, does not possess good keeping qualities, and, as has been already remarked, is not nearly so digestible. The development of rancidity—a tallowy, cheesy smell—is characteristic of spray powders (full cream) and develops after a few months, particularly in the tropics. Rancidity is an indication that the powder is not fresh, or is keeping badly and although a sign of age or poor quality in any milk powder made by no matter what process, it is not definitely injurious if the powder is used only for a short time. This is a distinct advantage over condensed milk, which if once exposed to the air through damage to tins, etc., rapidly decomposes and becomes toxic. Spray powder when once mixed has a more complete solubility, but in the mixing is inclined to cake into little insoluble balls. On the other hand roller powder mixes easily without this phenomenon, although the fat does not remain in as good a state of emulsification.

The use of a machine termed an emulsifier is unnecessary where full-cream roller powder is used, although advisable with spray powder owing to these mixing difficulties. Where full-cream roller powder is used the requisite quantity can be taken from its tin and merely stirred into a hot dixie of tea; but in large standing barracks or camps, or on board ship, when mixing in bulk quantities is required, the use of such a machine may under circumstances be advantageous to facilitate and expedite centralized preparation. These emulsifiers, popularly known as "iron cows," are used on many steamships and mix up spray process separated milk powder and butter. The use of full-cream roller powder, which obviates the complication of the addition of butter and presents the possibility of simple mixing without any apparatus, is becoming more general owing to the better keeping quality and solubility of present day roller powder, the manufacture of which in the last few years has improved enormously.

Condensed milk, as now supplied to the Services, is unsweetened, and packed in 12-ounce tins, 4 dozen in a wooden case—a case having a liquid equivalent of 9 gallons.

Roller milk powder can be supplied in 12-ounce vacuum tins in wooden cases of 2 dozen—a case having a liquid milk equivalent of 13½ gallons.

The following table shows the comparative data and gives an economic comparison of roller process milk powder and condensed milk. It shows at once the respective merits of the two alternative forms of preserved milk available for military purposes.

TABLE IV.

	12-oz. tin					1 Case			
	Liquid milk equivalent	Cubic capacity in cc.	Cost	No. of tins per case	Warranty period	Liquid milk equivalent	Cubic capacity	Gross weight	Warranty period
Evaporated milk	1½ pt.	420 c.c.	Same	48	1 year	9 gal.	1·2 c. ft.	53 lb.	1 year
Milk powder ..	1½ pt.	980 c c.	Same	24	2 years	13½ gal.	1·2 c. ft.	40 lb.	2 years

i.e.—1 lb. gross weight evaporated milk is equivalent to 1·36 pints milk (calory value 462).
1 lb. gross weight milk powder is equivalent to 2·70 pints milk (calory value 918).
or— 1 cubic foot of an evaporated milk case is equivalent to 7·5 gallons milk (calory value 20,400).
1 cubic foot of a milk powder case is equivalent to 11·1 gallons milk (calory value 30,192).
or— 1 gallon milk (calory value 2,720) carried respectively in the form of evaporated milk and powered milk is characterized as follows :—

TABLE V.

Equivalent of 1 gallon		Weight (gross)		Capacity (gross)		Cost
Evaporated milk	..	5·88 lb. (1 gal.)	..	0·13 cubic feet	..	Same
Milk powder	..	2·96 lb. (1 gal.)	..	0·09 cubic feet	..	Same

The above data, therefore, show clearly that milk powder, if substituted

for evaporated milk, would mean a *reduction in weight of one-half and in bulk of one-quarter of the Army's milk ration and would involve only half the present turnover of stocks owing to its two-year warranty.*

From the point of view of transportation, condensed milk having sixty-five per cent of water is seen to be thoroughly uneconomic, while its calory value is less than one-third that of milk powder. To take an example, 1½ ounces of condensed milk is the normal daily active service ration, of which nearly one ton a day is used by a division at full strength. This means that ten hundredweights per day per division in the shape of unevaporated water is needlessly carted about, probably involving many hundreds of wasted ton miles between point of origin and point of usage, while apart from this the product thus laboriously handled is only one-third as productive of energy as the article which could be so advantageously substituted for it. *All this waste* of time, labour and transport is avoided with powdered milk, which has three times the food value, contains not more than two to three per cent of moisture, and is in its dry state only half the weight of a corresponding equivalent of liquid milk in condensed milk form.

To sum up, in comparison with condensed milk, *all* powdered milks have the following advantages:—

(1) Weight for weight, they are half again as compact because they contain, practically speaking, no water;

(2) They are more than three times more nutritive and energy producing;

(3) They are more sterile, cannot become "blown" or "decompose" even if tins are damaged in transit, and can be used without danger even if several years old;

(4) They are more digestible—of value on the ground of conservation of energy;

(5) More hygienic and economical in use, as the tin can be re-closed after initial opening, and used again, while flies are not attracted to a dry powder.

They can therefore, as we have seen, justifiably claim superiority to condensed milk on practically every score—economy, food value, transport, length of life, sterility, palatability, digestibility, vitamin and mineral content, and economy in use.

Of the powdered milks, those made by the roller process, or better still, if obtainable, those made by the improved roller process, perfected by a well-known firm of milk food manufacturers, are the more suitable for military purposes owing to:—

(1) Far better keeping qualities, nearly double that of condensed milk and spray process powder.

(2) Greater sterility.

(3) Higher mineral and vitamin contents which are not impaired by the short heat treatment involved in the roller process.

From an impartial and unprejudiced survey of the desiderata, and of the degree in which these are satisfied by roller process milk powder, one is forced to the conclusion that in the use of this form of preserved milk, whenever fresh cow's milk is unobtainable, lies the ideal solution to the question of the Army's milk supply.

REFERENCES.

MAGEE and HARVEY. *Biochem. Journ.*, 1926, 873, 885.
MILROY. *Ibid.*, 1915, ix.
HARTWELL. *Ibid.*, 1925, 1, 1073.
SOMMER. *Proceedings World's Dairy Congress*, 1923.
SAVAGE and HANWICKE. Food Inspection Board Special Report, 1923, 13.

Editorial.

VACCINATION.

In the November number of the Journal, 1928, we gave a summary of the first report of the Committee appointed by the Minister of Health, in conjunction with the Medical Research Council, to study certain matters in relation to vaccination. Among other recommendations the Committee suggested that provision should be made for the continuance of experimental investigation with a view to the furtherance of knowledge of vaccinia and of the virus diseases in general with special reference to the pathogenesis of the nervous complications which occasionally follow these diseases. They also considered that experiments should be made to ascertain if it is feasible to increase the dilution of vaccine lymph beyond the present degree without impairing its efficacy.

The further report of the Committee dealing with the work carried out in accordance with these suggestions has been issued by the Ministry of Health.

Information has been collected regarding the epidemiology of ninety cases of post-vaccinal disease of the nervous system occurring in the period October 1, 1927, to September 30, 1929, in England and Wales.

In their commentary on the cases the Committee state that an acute nervous disease with a mortality of fifty per cent continues to appear intermittently without relation to any known factor other than vaccinia by whatever vaccine produced. It is associated with characteristic changes in the brain and spinal cord similar to those found in the acute nervous affections occurring after measles, influenza and variola, but unlike them nearly always being manifested within a definite time after infection.

The interval between the dates of vaccination and of onset of nervous symptoms varied in eighty-three primary cases from two to fifteen days, with an average of 10·2. Of the twenty-five fatal cases in which the diagnosis of post-vaccinal encephalitis was confirmed, twenty-three followed primary vaccination, and in these the interval between vaccination and onset varied from six to fifteen days, with an average of eleven days. Three cases were recorded following re-vaccination: in one case in which the diagnosis was confirmed, the interval was thirteen days; in the second case, with marked clinical symptoms, the interval was twenty-three days; and in the third, a doubtful case, eight days.

Chart I of the report giving the period elapsing between date of vaccination and date of onset of illness in ninety cases, shows the grouping mainly between the fourth day and the sixteenth day after vaccination. This is a very significant fact to which reference will be made later.

There was a certain geographical grouping of the cases notably at Bristol, Stoke, Kingston, Wereham, and West Ham, while simultaneous multiple cases occurred near Norwich, at Wandsworth, and at Winterbourne

in Berkshire. These eight groups contain no fewer than forty-two of the ninety cases investigated.

The Bristol and Wereham groups were subjected to detailed examination. Nine cases were brought to light, seven in Bristol and two in the contiguous urban district of Kingswood. Six of the cases occurred within an area of one square mile in the centre of Bristol at a time when there was in that area a certain incidence of the notifiable diseases of the central nervous system in children *not* vaccinated. Smallpox appeared in Bristol during the week ending October 22, 1927; a vaccination campaign was organized throughout the schools, and before November 21, 9,000 children had been vaccinated. The cases of post-vaccinal nervous disease occurred when the consumption of lymph was abnormally high, but the incidence was not proportionate. Three cases diagnosed polio-encephalitis and acute poliomyelitis occurred among children *not* vaccinated during this period, but thorough investigation failed to establish any association between the vaccinated and unvaccinated cases. The Committee state that the incidence of nervous disease upon the newly vaccinated is much greater than can be explained on the hypothesis of fortuity.

The period elapsing between the date of vaccination of the nine cases and the onset of symptoms varied from seven to twelve days. In no case had there been a previous vaccination, and in all of them Government lymph had been employed. All the cases were vaccinated at schools, but there were six schools concerned. The only factor common to all of them was vaccination at school, but no two cases occurred in the same school, and vaccination was done by six vaccinators using seven different lymphs on eight different days.

In the Wereham group of five cases which occurred in a small and compact community of 500 persons, attention was directed to family incidence, association of invaded households, common infectious diseases, and diseases of the central nervous system. Little emerged from this investigation except that two cases were brother and sister, three cases attended the same school, and that in the district there had been cases of influenza followed by nervous complications.

The grouping at Bristol and Wereham had been previously seen in Sheffield and at Monmouth, Glamorgan. The familial incidence at Wereham and Winterbourne had occurred at Eynsham and Wallington. The age incidence was the same, two-thirds of the patients were of school age. No clinical features not previously observed were met with. The loss of consciousness which was so striking might suggest uræmia, and it might not be without significance that in two confirmed cases there was congenital absence of the kidney, and in a third, ulceration of the bladder and degenerative changes in the kidneys.

The Committee then studied the relation between the ninety cases and (1) the number of charges of lymph issued to public vaccinators; (2) the incidence of poliomyelitis and polio-encephalitis; (3) the incidence of encephalitis lethargica; (4) the incidence of smallpox.

The relation between the post-vaccinal cases and the number of vaccinations—the population at risk—was clearly shown although it was neither demonstrably constant nor regular. There did not appear to be any relation between the incidence of poliomyelitis and of polio-encephalitis and that of post-vaccinal nervous disease, nor could any bearing of encephalitis lethargica on post-vaccinal nervous disease be traced.

Of the 90 cases 83 had not previously been vaccinated, 3 had, and in 4 it was not possible to determine whether there had been a previous vaccination or not. There was nothing to indicate any constant relationship between the number of insertions and the onset of disease. No particular intensity of local reaction was observed, and no case developed generalized vaccinia.

The Committee state that there is evidence, to which we shall refer later, that a skilled vaccinator using lymph diluted 1 in 100 may be successful in every case and that, with minor modifications in the local reaction, primary vaccination with this dilution runs the same clinical course as with a dilution of 1 in 5, but is accompanied by less marked evidence of systemic invasion. The spleen is less frequently palpable and the temperature is lower. In some persons vaccinated simultaneously with 1 in 10 and 1 in 100 dilutions, it is difficult clinically to differentiate between the lesions produced.

The various lymphs used in this country differ in potency, but they must all comply with the minimum standard laid down in the Therapeutic Substances Act, 1927. The prepared lymph diluted 1 in 1,000 with physiological salt solution when applied to the suitably prepared skin, or superficial epithelium, of a rabbit or guinea-pig must produce the characteristic lesions due to vaccinia.

The records show that the use of every one of the Government lymphs has, at one time or another, been followed by nervous disease, and the Committee believe that little assistance in averting the occasional occurrence of acute nervous disease can be expected from dilution only.

Experiments have been made by Dr. John Bland under the supervision of Dr. S. P. Bedson to determine whether vaccine virus inactivated by heat or chemical agents such as formalin and phenol is capable of conferring immunity to the living virus. The results seem to indicate that little or no solid immunity can be conferred in this way.

The pathological investigations in the twenty-five fatal cases of encephalitis following vaccinia were carried out by Dr. Greenfield, Drs. Fairbrother and Hurst for Professor Ledingham, and Dr. Perdrau. Four fatal cases of encephalitis following acute infectious diseases were also examined.

Dr. Greenfield and Dr. Hurst reported on a case of acute disseminated encephalo-myelitis following variola. The lesions were stated to be in all essentials similar to those occurring after vaccination. Perivascular infiltration with large and small leucocytes in many parts of the brain and cord

and zones of demyelination were found round many of the vessels. Throughout the brain-stem the areas of damage were mostly confined to one side, and in the cervical region this unilateral distribution was absolute, but at lower levels both sides of the cord were affected.

A case (numbered 140) of post-vaccinal encephalo-myelitis investigated by Dr. Fairbrother showed the usual perivascular infiltration in different regions of the brain and cord and the usual demyelination on the application of the Weigert-Pal stain, but was peculiar in that the changes in the spinal cord were strictly limited to the right half; the left side, except in the lower dorsal region, was completely spared.

Dr. Greenfield examined a case of encephalo-myelitis following measles and two cases of acute disseminated encephalo-myelitis following influenza. He stated that the lesions found in the influenza cases were of the same kind as those found in the encephalo-myelitis which sometimes follows vaccination, smallpox, and measles. The cases are considered by him to support the view that disseminated encephalo-myelitis is a disease *per se*, which may be brought on or directed against the nervous system by certain febrile or exanthematous diseases.

It may be noted that Kling claims to have successfully inoculated rabbits with different strains of virus from human encephalitis; but the pathological condition, which was associated with the presence of "Encephalitozoon" bodies, did not develop for several weeks.

McIntosh (1920) also stated that he had succeeded in transmitting encephalitis to monkeys, but the incubation period was also a very long one

The Committee state that the present report adds no new facts to our knowledge of the pathology of post-vaccinal disease. They, however, draw attention to the absence of the usual symmetry of the lesions which was noted in Case 140 of post-vaccinal encephalo-myelitis, and which was also seen in the case following variola.

They consider the claim of certain authors that the lesions of post-vaccinal encephalitis are similar to, if not identical with, those of the nervous affections observed after certain acute infections, notably the exanthems, has received further support. Hurst and Troup confirmed this in smallpox, Wohwill and Greenfield in measles, Greenfield in influenza, and, still more recently, Bassoe and Grinker in the case of the nervous complications of antirabic inoculations.

Drs. Fairbrother and Hurst injected emulsions of brain material from seven proved cases of post-vaccinal disease into monkeys and rabbits, intracerebrally, without producing any effect. They also made intradermal injections and scarification tests in rabbits, but did not obtain any reaction. They failed to obtain any evidence of the presence of some virus transmissible to monkeys and rabbits.

The Committee state definitely that no condition simulating post-vaccinal nervous disease has so far been produced by the inoculation of monkeys with this material, either by the intracerebral, intravenous or intramuscular routes, and whether the experimental animal was simultaneously vaccinated

with calf lymph or not. They consider that the ætiology of the disease still remains obscure.

Some curious points, however, have arisen in connection with the treatment of cases of encephalitis with the serum of convalescents from vaccinia. A child suffering from some ill-defined disease was waiting with its mother in a room at St. Bartholomew's Hospital, where they came in contact with another child proved to be suffering from smallpox. The child and the mother were vaccinated then and there with four insertions of lymph. The vaccination took well in both mother and child. On the sixth day following vaccination the child became drowsy, then stuporose; on the fifteenth day, at Dr. Gordon's suggestion, the child received an intrathecal injection of 5 c.c. of the mother's serum. Four days later there was a rapid improvement in the child's mental condition and she recovered completely.

In this case it might be supposed that the virus of vaccinia activated another virus, as the child was ill when vaccinated, and that the cerebral symptoms were the result of the combined viruses. The case would then conform to the suggestion made by the Committee in their first report, that the cerebral symptoms in vaccinia are most probably due to an unknown virus activated by the vaccinia. The curative action of the mother's serum suggests the action of a specific vaccinal antibody in this serum. The Committee state that they are in agreement with Sir Thomas Horder that the amelioration of symptoms following intrathecal injection of the mother's serum can in no way justify the inference that the disease was due solely to the virus of vaccinia. The possibility also of a non-specific effect following the injection of any form of serum cannot be excluded.

In Holland, during August and September, 1929, Hekman, unaware of Horder's case, employed the same treatment in a series of eleven children suffering from typical nervous symptoms following on vaccination. Serum from parents who had been recently vaccinated was used, and eight of the cases recovered. But in one case the serum of the father who had been successfully vaccinated four years previously was employed; the child recovered.

Grüneberg also reports two cases treated in the Altona Hospital, Hamburg. Serum from recently vaccinated nurses was given, with successful results.

Hekman does not accept the theory that the nervous symptoms following vaccinia are due to an unknown virus activated by vaccinia. He is satisfied that the virus of vaccinia is alone to be incriminated because its "neurotropic affinities are well established." He considers that his view is supported by the results of the serum treatment. Netter holds a similar opinion.

In a recent paper Dr. Russell Brain points out that the clinical pictures, mortality-rates and prognosis as to functional recovery are quite different in post-vaccinal encephalitis, measles encephalitis and varicellar encephalitis. If we are to suppose that they are caused by the same virus we must regard this as being modified by the different infections. He thinks it is less speculative to consider that the different conditions are produced

by different organisms—namely the viruses of measles, vaccinia and chickenpox.

In order to explain why the virus of vaccinia has in recent years lost its normally inoffensive properties Hekman suggests that rabbit passage in the course of lymph preparation may be a possible factor. Netter also suggests that passage through rabbits increases the pathogenicity of the virus.

In a histological study of two fatal cases which occurred in Sweden, Kling succeeded in demonstrating in the brains of the two children the presence of round or oval bodies, which he considered to be protozoa.

In this connection it is interesting to note that Woodcock found perivascular infiltration and "Encephalitozoon" bodies in sections of the brain of a rabbit that had been vaccinated some weeks previously by Ledingham.

The Committee consider that the cases cited form a powerful argument for the use of human anti-vaccinal serum in treatment, which should be started as soon as possible. They recommend large institutions requiring vaccination or re-vaccination for admission, to preserve serum for use. When human serum is not available, an anti-vaccinal horse serum prepared by Dr. Petrie is stated to be available for trial.

With regard to the employment of rabbits in lymph preparation the Committee admit that recent work has demonstrated the highly enhanced virulence for the rabbit of vaccine virus which has been repeatedly passed through certain rabbit organs (neuro-vaccine and neuro-testicular vaccine), but state that there is no evidence, so far, that in the rabbit it is possible to induce an encephalitic process with such a virus provided it is not inserted directly into the brain. Neuro-vaccine has been largely used in Spain but has to all appearance not been followed by encephalitic sequelæ. In Holland, however, cases of encephalitis followed its use, just as they have done after the use of dermo-vaccine. In the preparation of dermo-vaccine rabbits have been used for the propagation of the seed lymph used for the inoculation of calves. But the Committee state that the practice was in existence in this country many years before the appearance of post-vaccinal encephalitis. They consider that there are no valid grounds for the belief that rabbit passage *per se* in the course of lymph preparation plays any part in the production of encephalitic sequelæ. They have been informed from a Continental source that post-vaccinal encephalitis has followed the use of lymph in the production of which the rabbit was not employed (e.g., in the cycle child-calf-child). Although no particular lymph can be incriminated, they say that it is clearly the vaccinia virus, whatever its past history and in whatever medium incorporated, which initiates the nervous disturbance, but why this disturbance should be limited to a few individuals of a particular age group is not known. The grouping of cases in place and time and the tendency to familial incidence suggest to them the existence of local individual predisposition in the widest sense of the term.

Clinical and other Notes.

EMERGENCY MOTOR AMBULANCES.

By Captain H. H. BERRIDGE,
Indian Army Service Corps,
AND
Major T. O. THOMPSON,
Royal Army Medical Corps.

India to-day is in the throes of becoming mechanized. Demands are many and money is scarce.

In countries that are in the process of becoming "civilized" the "regrettable incident" must be expected. When it happens, an "emergency" arises and has to be dealt with.

Even the most efficient military machine requires a certain amount of time to become operative, and usually by the time that the military machine is in operation the original incident will have become past history.

Therefore in countries such as the North-West Frontier of India one must be prepared to act quickly.

There are certain vantage points where troops are stationed, but even then they take time to reach the scene of an "incident."

A small party of troops may possibly get "shot up" and casualties occur. It is the law of the Frontier that the killed and wounded are not "left out" if it is humanly possible to bring them "in"; few things hamper a retirement more than evacuating last-minute casualties.

Now, one point about the Frontier is the fact that to-day all the posts, with the exception of four frontier towns which are situated on railways, are entirely dependent on mechanical transport to keep them supplied with their various daily requirements.

Motor ambulance convoys are scattered throughout the military stations of India, and are barely sufficient to meet normal requirements.

The light six-wheeled lorry is coming into its own, and in war will invariably be found in the "field areas." It has been found necessary, in the past, when the normal system of evacuating casualties has become swamped, to use supply lorries returning empty to assist in the evacuation. The idea that promptly suggests itself is that some arrangement is required whereby a normal supply lorry can be converted into an emergency motor ambulance to assist the normal system of casualty evacuation.

If the supply lorry could be easily converted into an emergency motor ambulance then the situation, visualized earlier, would also become simplified.

Captain Berridge therefore devised a series of hooks and straps by means of which the normal supply lorry body can be converted into an emergency motor ambulance in a few minutes.

The following essential principles governed the manufacture of these "conversion sets." They should : (*a*) involve no structural alteration to the normal supply lorry body; (*b*) be a standard fitting that will fit a standard body ; (*c*) be simple to erect ; (*d*) be capable of forming part of the lorry equipment and take up as little room as possible in the vehicle tool boxes ; (*e*) be light and durable ; (*f*) ensure the rigidity of the stretchers when the vehicle would be in use as an emergency ambulance; (*g*) be cheap in manufacture.

The materials required are 2 in. belting, either leather or balata, 1 in. by $\frac{1}{4}$ in. mild steel and a small amount of $\frac{3}{8}$ in. round steel.

The canopy stays of a 30-cwt. six-wheeler are made of $1\frac{1}{4}$ in. by $\frac{3}{16}$ in. angle iron. The span at the top is six feet. Now taking the beam of these dimensions supported at each end, it will be found that the bending moment in the centre is approximately with a weight of 0·4 of a ton.

Actually one quarter of the weight of the stretchers is distributed on the cross-beams, front and rear, on each side of the body at a spot about two feet from the point of suspension of the beams, thereby ensuring a large safety factor and ensuring that the beams will not collapse when under load.

Before the fittings were put up for the consideration of the Indian Government, the following test was carried out:—

Four men, weighing 180 pounds, 160 pounds, 150 pounds and 140 pounds respectively, were selected.

Looking from the rear of the lorry, the first pair were placed on the right-hand stretchers and the second pair on the left-hand stretchers.

For the supporting straps, which held the inner side of the stretchers, spring balances were substituted and the following weights obtained:—

(*a*) With the top stretcher only, shipped and occupied.

Right side		Left side	
Head of stretcher	45 lb.	Head of stretcher	40 lb.
Foot of stretcher	40 lb.	Foot of stretcher	40 lb.

(*b*) With both stretchers shipped and occupied.

Right side		Left side	
Head of stretcher	110 lb.	Head of stretcher	80 lb.
Foot of stretcher	80 lb.	Foot of stretcher	70 lb.

The fittings consist of:—

(*a*) *The Hook Straps.*—Four straps with hooks at each end; at one end the hooks are square-shaped to fit the canopy cross-beam, at the other end the hooks are rounded to grip the stretcher poles.

(*b*) *The Loop Straps.*—Four straps with loops at each end, big enough to push on to the handle of the ordinary G.S. stretcher.

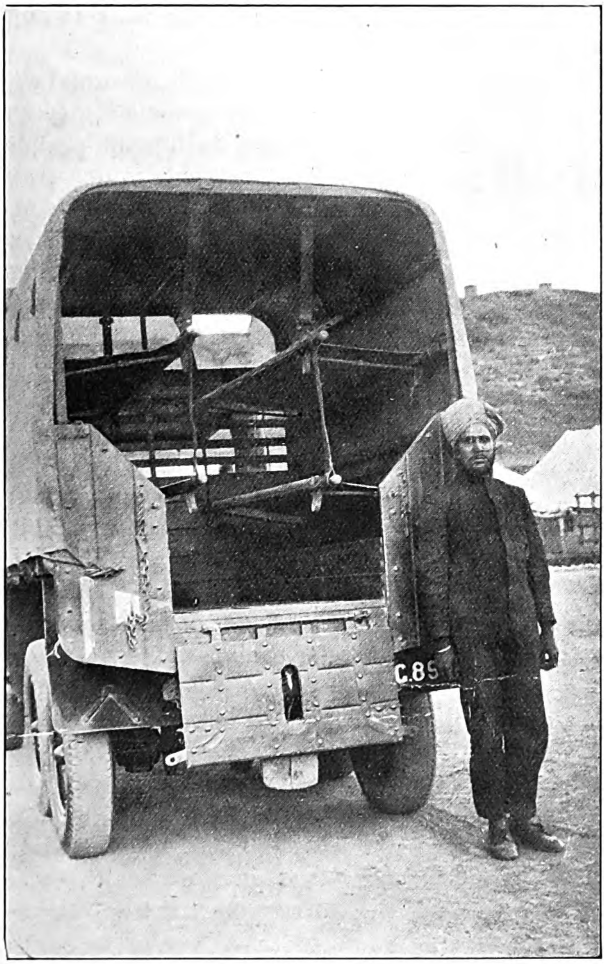
(*c*) *The "S" Hooks.*—Four "S"-shaped hooks for hanging on the top rave of the lorry body.

(*d*) *The Square Hooks.*—Four square hooks for hooking on to the lower outside body strengthening rave.

The hook straps are for hanging the inner side of the top stretchers

from the canopy stay, and it is essential that the lower hooks of these straps should be fixed from the inner side through the runner and round the inner pole of the top stretcher. The top hook should be hung upon the canopy cross-beam in line with the inner edge of the top stretcher.

The loop straps are for supporting the inner side of the lower stretcher which is hung from the inner handles of the top stretcher. It should be



noted that the handles of the G.S. stretcher are slightly hyperbolic in shape, therefore when the strap is once properly pushed on to the handle of the stretcher the more weight that is put on it the less it will tend to slip.

The " S " hooks perform the dual function of supporting the outer side of the top stretcher, and of holding it rigid and preventing any swing which might be set up by centrifugal force when the lorry is negotiating curves and corners. The outer pole of the stretcher should rest in these hooks.

The square hooks are for supporting the outer side of lower stretcher, and serve the treble purpose of counteracting centrifugal force, supporting the outside of the lower stretcher and holding it sufficiently away from the floor to prevent the occupant from bumping on the floor of the lorry when traversing rough ground. It should be noted that these hooks must be hooked over the body rave in such a position that they will hold the outer pole of the stretcher between the runners.

The accompanying photograph illustrates these facts and demonstrates the utility of the conversion set.

Every lorry in No. 23 M.T. Section, I.A.S.C., Bannu, has been equipped with one of these conversion sets, and their general utility has been proved time and again in various frontier episodes during the past three years.

Captain Berridge participated in a recent minor frontier operation when supply lorries were being utilized for the evacuation of sick. During a convoy halt it was found that two or three fever cases had become considerably worse during the journey. So an emergency motor ambulance was made, and the patients were each given a stretcher to lie on instead of just sitting in a supply lorry being bumped about. The fervent "Fank Gawd" from the lips of a "browned-off" British soldier, as he lay down, made Captain Berridge feel that his idea served to ameliorate the suffering of at least one person.

Major Thompson has evolved a drill for loading these "emergency ambulances," and the detail is given in the following paragraphs for those who may be interested in the easiest methods of converting a supply lorry into a motor ambulance.

Methods of Loading and Unloading.—The "conversion sets" are carried in a bag and form part of the lorry tool equipment in charge of the driver, who should hand them out for the loading squad.

Loading.—A loading squad consists of four Ambulance Section men—one N.C.O. and three others. The squad is halted 5 yards from the tail of the lorry.

No. 1 receives the conversion set from the driver and lays out the contents ready for use.

Nos. 2 and 3 undo the tail-board, and No. 4 assists the driver to clear the body of the lorry and rearrange the spare wheel, if this is carried inside.

No. 1 and No. 2 enter the lorry and fix the various parts of the conversion set as follows:—

(1) The square hooks of the hook straps are fixed over the front and rear canopy cross-beams, facing inwards, at a distance from the sides equal to the width of the stretcher, with the lower hooks pointing to centre line of lorry.

(2) The "S" hooks are fixed on front and rear ends of the top rave opposite to where the handles of the outer pole of each upper stretcher will be.

No. 2 gets out, No. 1 stays in, and the lorry is ready for first load.

Nos. 2, 3 and 4 fetch the first loaded stretcher; bring it head forwards

to the tail of the lorry; and, raising the stretcher pass it into the right side of lorry. No. 1 grasps the forward handles, raises the stretcher towards the right forward hooks; No. 2 mounts into the lorry to help No. 1, while Nos. 3 and 4 raise and push the rear handles until the stretcher is approximately in position.

No. 2 supports the front end of the stretcher, while No. 1 fixes the outer forward handle into the "S" hook and the inner forward handle into the curved hook of the "hook strap." No. 2 does the same with the rear hooks, while Nos. 3 and 4 support the handles. The curved hooks of the "hook strap" must be fixed round the pole and through the inner runner.

Nos. 1 and 2 fix a "loop strap" on to the forward and rear handle of the inner pole of the loaded stretcher and a "square hook" on to the body rave in rear of the forward canopy stay and forward of the rear canopy stay. Some little difficulty may be experienced in fitting these hooks properly over this rave.

Nos. 2, 3 and 4 bring up the second stretcher and pass it into the lower right hand side of the lorry, No. 1 fixing the forward end and No. 2 the rear end. The outer pole is fixed into the square hooks which should be now central to the runners. The loop of each "loop strap" is slipped on to the handles of the inner pole.

Similarly, the third and fourth loads are fixed in the top left hand and the bottom left hand position respectively, the tail-board is closed and the lorry is ready.

Unloading.—This is carried out in the reverse order, i.e., left lower, left upper, right lower, right upper.

No. 1 remains in the lorry to manage the forward end of the stretcher.

No. 2 enters to assist him to take the weight of the stretchers, while Nos. 3 and 4 support the rear end of each stretcher and withdraw it from the lorry, No. 2 holding the forward end and following the stretcher out. No difficulty is experienced in unloading.

Experience with the Lorry Ambulance.—The stretchers are held practically rigid. The upward tilt on the inner side of each stretcher is sufficient to prevent the patient being shot off the stretcher when the lorry turns rapidly. Our personal experience over broken ground, deep nullahs, etc., shows that a patient is quite comfortable and secure.

During "columns" and recent active operations these conversion lorries have been of great use. Motor ambulances are rather scarce and are often hoarded against sudden need of serious cases, whereas the returning six-wheeled lorry is often available in plenty, and this method of evacuation is the greatest boon to any Field Ambulance Commander. There need be no hesitation in sending even the most serious of casualties by this method, as the comfort is equal to any motor ambulance.

The only drawback, at present, is the fact that lorries are not provided with stretchers; and a field unit, unless there is an adequate dump of stretchers available, cannot afford to lose touch with its own stretchers for a day or two. It is understood that there is a proposal to carry reserve

stretchers in a certain number of lorries (two slung under the canopy on each side). If this proposal is brought into effect, the potential motor ambulances available for a force and the subsequent ease of evacuation will be enormously increased.

NOTES ON A CASE OF FRACTURE-DISLOCATION OF THE SPINE.

By Major M. MORRIS.
Royal Army Medical Corps.

Cases of severe trauma to the spine making an uneventful recovery are of sufficient rarity to warrant attention being drawn to this case.

It is now four months since, summoned by a wire, I was piloted to Alexandria by the Royal Air Force to see Private W., aged 23, of the 1st South Wales Borderers, who had dived from a height of about five feet into an open-air pool containing no more than two feet of water. The result of the dive was instantaneous acute pain in the neck, a clicking noise and inability to move the head in any direction at all. I found on arrival at Ras-el-Tin a healthy well-made soldier somewhat cyanosed in colour lying on his back and completely unable to move his head, which was locked. The chin was in the middle line and the head appeared to be slightly flexed. I could detect no alterations in his reflexes, and no paresis. The slightest movement of the patient produced agony.

Examination of the spine revealed no abnormality as regards position of the spinous processes. The neck was exquisitely tender on palpation.

Radiological examination revealed complete dislocation forward of the third on the fourth cervical vertebra with fracture of the upper anterior angle of the body of the fourth.

The articular processes were also fractured.

The patient was anæsthetized by Major G. F. Allison, R.A.M.C., and traction carried out on the spine by pulling on the head, my hands being held below the mandible. At the same time I gently rotated the head and flexed the cervical spine.

The patient was very cyanosed for a minute or two during the manipulations and gave us some anxiety, but a clicking noise, a return of good colour, and the fact that the head became mobile and movements of the neck possible, led us to believe that reduction had been effected. This view was borne out by another X-ray picture.

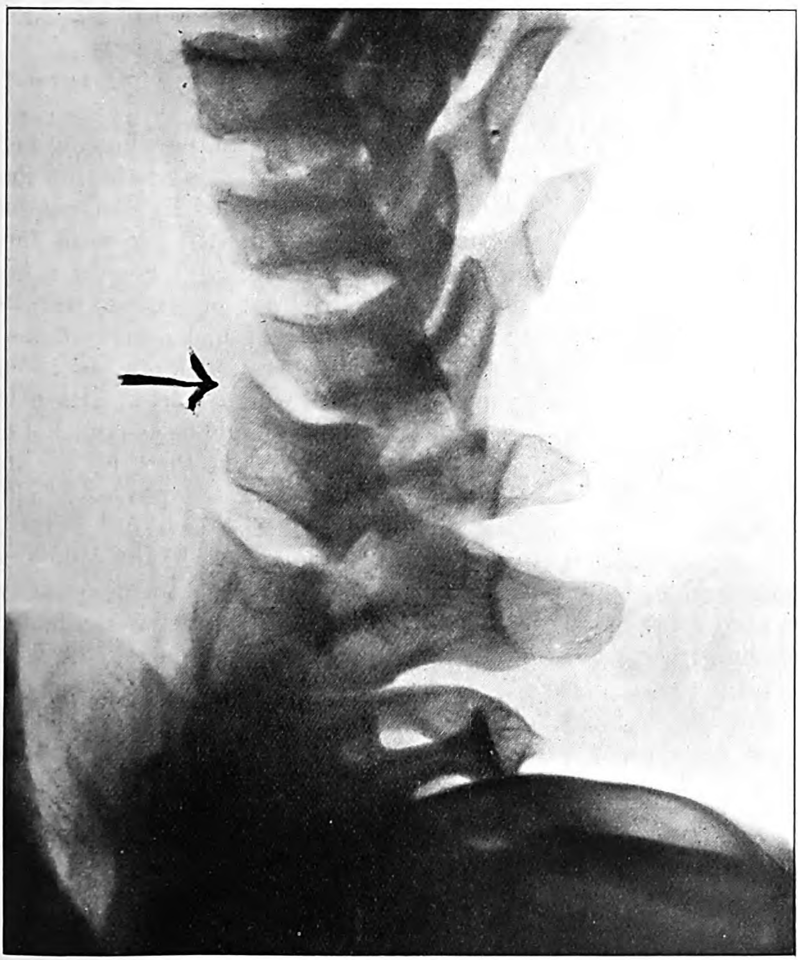
A figure-of-eight plaster bandage was then put round the neck, occiput and forehead. This was left on for six weeks. It was then removed and vigorous massage and radiant heat commenced—later, exercises were begun.

The patient is now on full duty. He is free from pain. Flexion and lateral rotation of the head are perfect. There is slight diminution of extension and he is unable to tilt his chin upwards more than a few inches. Radiological examination at present shows some callus formation, and I

am unable to explain the absence of any pressure symptoms throughout the history of this case.

This type of injury is of course caused by indirect violence and is known as a complete fracture or fracture-dislocation, as compared with the incomplete variety.

Dislocation would appear to be commonest between the fifth and sixth



cervical vertebræ, is most commonly unilateral, and almost invariably the result of forcible flexion of the head and neck with some rotation. In these cases the head is turned to the opposite side, is fixed, and the ear is raised, not as in the above case which was bilateral with the head fixed in the middle line.

My thanks are due to Lieutenant-Colonel A. H. Bond, R.A.M.C., for giving me the opportunity of dealing with the case, and to Major D. N. Macleod, R.A.M.C., for his help with radiography.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (*Ret.*).

(*Continued from p.* 149.)

I was delighted with the prospect of meeting Surgeon-General Farrell on active service.

I left Chunar by the mail and arrived at Calcutta the following morning.

I drew a Field Hospital out of store and pitched a section on the lawn of the Station Hospital, Calcutta, then commanded by Brigade-Surgeon Inkson (later Surgeon General). I was pleased with my work, for not a box or a rope was out of place. The next morning I bought a horse at Harts and rode down to the hospital. In front of me was the Brigade Surgeon damning everybody and everything that had destroyed his lawn, and when I calmly rode on to it his exasperation knew no bounds. I realized at once my iniquity and apologized, which started him off again. I was told to take the d——d things off, that I should be ashamed of myself, that I had no manners or sense of discipline, and then, as the thought struck him, "Why the d——l have you not reported yourself?" "Have you any right to be in Calcutta at all?" The dear old Brigade was perfectly right and caught me like a flying pigeon. I saluted and gravely rode away and wrote an official apology. I also packed the hospital at once, and waiting a day or two called again and fully admitted my fault when, to my relief, he was most kind and gracious, and just remarked, "You were a little bit too keen, Morris." I met his son once on my way out to India, "a chip of the old block," and wearing the Victoria Cross. A day later I embarked on a mule transport ship for Rangoon, and this was another experience. It was a sight to see the mules hauled on board and the officers watching the tails as they were in the air to see that they did not stand up on end, which would have been a sign of death. It was curious, as we ran past the James and Mary shoal, to see the ship apparently heading straight for the shore and then gently wear round to safety. The weather was hot and the wind ahead, and this brought the smell of the mules to us. It was appalling, I have never endured anything like it. I welcomed C. Negrais three days later as we entered the Rangoon River and passed up stream with the delta of the Irrawaddy on our left. Bearing round to the left we saw Rangoon with the Shway Dagon Pagoda shining in gilded majesty over it. We tied up at a quay and our horses were put out. As soon as I could, I mounted and went to have a look at the place. Suddenly I ran close to a steam tram which frightened my steed and he immediately bolted. I soon got out of the street and turned the beast into the slush and mud by

the shore. As I sat on the horse and in a quandary, a gentleman in a black frock coat and mounted on a beautiful horse noticed my dilemma and shouted to me. I got out of the mud and he asked me where I had come from. I replied, "From India." He said, "Not on horseback?" and then I told my story. He invited me to stay with him, and I accepted provisionally till I knew better what orders were waiting for me. I promised to call on my new friend, who was Mr. Meares, Recorder of Rangoon. I rode away to the ship and looked to my charge and then searched for quarters. The only place I could find was half the billiard table at Reynolds' Hotel.

I was tired and went to bed. I was disgusted at seeing another officer and stranger sharing my billiard table. I tried to sleep in the awful place, short of air and full of mosquitoes. The next morning I got up early and had not spoken to my bed-fellow. On the second night we got into bed, when he said, "It is hot; shall we have a game of billiards?" and suiting the action to the word we ripped off the bedding, lighted the lamps, and procured some soda-water from Reynolds and played a game, a sweltering, trying performance. Later we went to bed, and how pleasant we were to each other. "Will you get in first?" "No thank you," was the answer, with a "Please do" to follow. We then found out who we were, and where we came from. I made a great friend whom I often met afterwards. This was More Molyneux, later Director of Intelligence of India.

My orders arrived directing me to remain in Rangoon for a week longer, so I packed up and went to live with Mr. Justice Meares.

I left Rangoon for Mandalay by river, in the s.s. "Alompra," commanded by Captain Rimmer, a genial and pleasant skipper. We dropped down the river towards the delta of the Irrawaddy, and Rangoon and the Shway Dagon disappeared from sight as we turned into a creek leading to the great river. The delta is composed of numbers of these creeks and muddy reedy places, and there are many water birds of all kinds flying in the air or wading in the water. The vegetation was thick and luxuriant, reaching to the water's edge, from which a hut would now and then peep out. These are usually built on piles in the water. How anyone could live in such a place puzzled me, but they did and earned a livelihood by procuring and preserving fish. After a few hours steaming in this awful creek, we suddenly ran into the Irrawaddy, and once more breathed freely.

Our party was the same as the one that crossed in the mule boat, except Pedlow, who went up country before us, and now we received the news that he had succumbed to cholera at Minhla. He was a quiet and rather sad man from the green isle, but a soldier with much experience, and as a Captain very much senior to us.

Every now and then we tied up to the shore to take in passengers. Once we stopped at Henzada, a considerable place, and here we began to appreciate Burma. It was very pleasant watching the Burmese, and especially the women in their pretty dresses and coloured silks; they had a lively and cheerful manner, so different to the down-trodden women of

India. We walked to the bazaar where I spotted a concertina. I took it down and played to a big crowd. We forgot to send the hat round and earn some money; I think it would have paid, so much did they appreciate the music.

The river is flanked by undulating ground with the higher Shan Hills in the distance on the right, and the Aracan Mountains on the left. The colouring was very beautiful, especially towards evening. On every hill stood a pagoda. These vary in size from magnificent temples to the meanest mud erection. They usually shelter a Buddha, and the images of this holy man are easily procured in every possible material and at any price. The pagodas are plastered in white and the larger ones have gold leaf laid over them. There was a wonderful picture as we entered a lovely stretch of water near Prome; the reflection of the blue sky in the river was most striking, with wooded green jungle extending to the water's edge, and the white pagodas standing out against the rich foliage of the forest. Not far from here and only a few days earlier my old General, Sir Herbert Macpherson, V.C., died.

We did not reach Prome for about ten days. Our progress had not been very fast owing to a strong current against us. The river begins to narrow at Prome, which enables the traveller to identify objects on the shore. One afternoon I noticed a procession on the bank carrying a large paper pagoda, which was held over a dead Burman. It was a funeral.

Lying in a bunk in the early morning, it is soothing to listen to the boatman sounding the depth of the water. He emits sounds like a part of the Westminster Chimes as he calls out, "Tihe baum milla nahin" (euphonetically).

The river abounds in sand banks and rises and falls very quickly, so that even the best sailors find it difficult to avoid stranding. If the engine is not strong enough to cross the bank or draw backwards out of it, other methods have to be employed. This sometimes becomes a lengthy business, and then those in the boat miss the breeze and feel the heat. If a steamer gets firmly fixed, two or three lascars take an anchor in a boat and lay one on the right and another on the left. By winding the windlass up to one, and then the other, the boat gets over or is drawn back into deeper water and is able to proceed. Wire hawsers are used, and sometimes snap with dire results. One captain lost both his legs in the recoil, his legs being shaved off as with a razor.

When we stopped at a place the women, dressed in the most engaging colours and smoking big cigars, would look at us with a quizzical interest, while the men slowly and lazily applied themselves to some heavier tasks. They are a lazy, idle lot of men, and have only to work for one month in a year, unless they are purposely stimulated. The women do all the bartering and "wear the breeks." Among the crowd are yellow-robed phoongies, or priests, and persons attached to a monastery. It is interesting to watch these monks with their eyes cast on the ground, with every

semblance of great humility, and a strip of bamboo over the shoulder with a basket suspended at each end. Between the front basket and the monk a triangular gong is hung, which he beats as he slowly trudges along the roadway. As he passes the people run out and place food in the baskets, and quite impersonally, for the monk does not take the slightest notice. The food collected each morning by these priests is taken to the monastery and divided up. A certain amount is put aside for the sick and feeble, some for the monks themselves, and the rest for beggars and the poor and for the animals. We were near enough to see the busy life in the monasteries in the morning.

Burma is one of those lands where kings could move their capital at their own sweet will. Consequently we saw some of the old capitals, such as Pagan and Ava, before we reached Mandalay, or, as the Burmese call it, Shway Myo. Completing our business at Prome, we left and in a short time crossed the frontier into the enemy's country at Allymyo and tied up on the left bank opposite Thayetmyo. We heard sad news here of three soldiers of the South Wales Borderers having been caught by a party of dacoits and crucified head downwards and mutilated. A punitive column set out immediately under Major Harvey, and so well did they do their work that this district afterwards became the quietest during the war. Swift and condign punishment for ill deeds is the secret of order and good government. Sentiment is out of place, for such persons only respect power and their own skins. We passed Minhla and Menbo, and arrived at Pagan, near the junction of the river Chindwin with the Irrawaddy. The scenery had become wild and more hilly, and pagodas seemed to rise on every eminence, but in other respects there was nothing striking, except the holy mountain of Popa. We did not land that day, but in the evening enjoyed the Feast of Lanterns. On this occasion everyone places a light in all available places and floats little boats with a lighted oil wick down the river, while the air resounds with the merriment and laughter of this gay people. The idea that they were at war was the last thing occurring to them. We reached Mandalay soon after.

Early in the morning I rode from the shore to the palace where the G.O.C. lived with his staff. I had also heard that I was getting an appointment on the staff. It was a lovely ride, and I felt in a veritable paradise, with the sky so blue, the sun so bright, and everyone dressed in different shades of colour and appearing so happy and gay. Here again, at the heart of things, the idea of a treacherous war being waged seemed absurd. I could see the centre tower of the palace as a filmy mass of gold delicately shimmering in this warm land of light. My direction took me to an angle of the wall and moat round the palace. The wall of this wonderful place stands about twenty-six feet high, relieved by small pagoda-shaped towers equidistant from each other. The wall is built of red bricks, while the towers are tipped with gold leaf. One hundred feet from the wall is a deep moat of the same width, and covered with beautiful

water lilies, and upon it was the King's barge, neglected and damaged. It consisted of two long canoe-shaped hulls lashed together, with one deck in the centre of which rose a slender wooden pagoda, richly carved and covered with gold leaf. The woodwork was painted a rich brown. At the prows were two carved dragons, and behind them two Nats, ugly-looking carved devils, whose function was to protect the monarch on his journey.

Half-way down each side of the palace stood a handsome bridge, stuccoed in white, over which ran a good road, passing under a strong archway to the central tower. Riding under it, I next saw the inner stockade. This is immediately around the King's residence, and very strong. I rode close to several magnificently carved residences, such as the King's and the Queen's Monasteries, and reached the Hall of Audience, which had been converted into officers' quarters, partitioned off by matting. The principal officers and offices were established in the larger rooms of the palace. I was given a quarter in the Hall of Audience, after I had reported my arrival. Colonel Buyers was the inspecting Royal Engineer, and arrived about the same time as I did. His quarter was opposite mine, across the inner square. He was getting ready for a bath, which was being prepared for him in a large vase, one of the palace properties, intended for anything but the ablution of a British officer. Having soaped himself all over, he got into the bath, which immediately capsized and he was fired through the matting screen into the square. It was very amusing, but the Colonel never flinched and waited till his vase was refilled and more securely fixed. The Headquarters Mess was in a magnificent room, very large and high, the walls of which were covered with mirrors, in between which were artificial flowers under glass. The painted ceiling was a wonderful production. In my room my bed lay against one side of the structure upon which had been King Thebaw's throne.

The Hampshires relieved the Somersets, and on the night of the change some wild cat took it into his head to fire a few rounds of ball cartridge into the Serjeants' Mess. Luckily he hit no one, but he created a terror among those gentlemen which they never expected. He was seized, and the incident ended. These very occasional escapades did some good, for they caused a break in a rather monotonous life.

Surgeon-General Farrell gave me charge of the Ambulance Corps, which I had to organize, equip and train. I had to arrange all medical details when columns went out. I moved from the palace to Mandalay Hill, where there were two hospitals and the Medical Mess, which I joined. Colonel De La Corbett was the S.M.O., with Surgeon-Major T. W. Patterson, P. M. Ellis (afterwards Surgeon-General), J. Beamish, H. J. Dyson (of the I.M.S.), L. A. Waddell (now the distinguished Oriental scholar), Lynden Bell and others. The days were very much alike, but I had plenty of work, and was well helped by Serjeants Nyren, Walters, Young and Arnauld. They did grand work, but I have lost sight of all except Young, who is now a Captain with a splendid record. I frequently

see him; in fact, all through my service we have often met. He has become rather rheumatic, but the keen blue eye is still bright, and he maintains the alertness and general smartness which always characterized him.

Among my friends was the Sadaw or Buddhist Archbishop of Burma. He lived at the Incomparable Pagoda, and I frequently paid him a visit. I forget how I first came to know him, but he had given all officers a friendly invitation to call on him, and I must have availed myself of this. He liked to receive about 5 p.m., when the heat and work were over. On my arrival I was ushered up several handsome steps, ornamented with carving and dragons, and all of a dazzling whiteness, to a flat roof, where the old Archbishop lay on a mat. He was a small man, looked feeble, and very wasted and old. He was a typical ascetic. I was at once struck by the beautiful expression of his face, which bespoke a great benevolence and kindness as he smiled and invited me to sit. A monk interpreted our conversation which ranged over many things. He was very curious about the sea and England. Once he directed my attention to the dome of a ruined pagoda which once belonged to some royalty, and indicated a crack through which a pipul was breaking its way. He remarked that the pipul was his friend, the English Queen, and that it would grow and displace the Alompra Dynasty. This frail old man was a great power in the land, and comported himself with much dignity. He wore the usual habit which, if I remember rightly, was white and not yellow, while his fingers played over his rosary of beads. His head was bald and he kept the sun off by holding a palm leaf over it, or fanned himself. The Chief Commissioner and the General were greatly helped by his loyal advice.

One afternoon I was talking to Donald Smeaton[1] when a Burmese lady rushed in complaining that her dog had been taken by some soldiers. She knew the barrack, and Smeaton asked me to go with her and try and retrieve it. He whispered that this lady was the Limban Queen of King Thebaw, but had not been included in the wives he took as a State prisoner to Ratnagiri. I believe he only took one or two, and of course Queen Supyalat, but in his palace he had a queen for the four cardinal points of the compass, and this lady, the Limban Queen, represented the South. He filled up most of the remaining points with casuals. The chief queens were principally chosen on the grounds of policy. Queen Supyalat had a hideous record for cruelty and even murder. The soldiers called her the "'oly terror," which compliment she had well earned. I proceeded to the barrack and found the dog, which ran to its mistress. It had strolled into the room and the men were feeding it. As I entered the men were called to "Attention," which so unnerved the lady that she clasped me. I withdrew as gracefully as I could with my royal encumbrance, feeling as scared as she was. She let me go outside and we returned to Smeaton,

[1] Chief Secretary.

when she gracefully thanked us. I often met her afterwards and she always gave me a kind smile.

My wife arrived later, and I had to establish her in a rather odd quarter in the "C" Road. It was composed of an upper floor, and approached by a ladder through the drawing-room. It was awkward, but she was not deterred and soon we were very comfortable. Everyone called on us, and Donald Smeaton, one of the very best of fellows, became an intimate friend. Sir George White and the Commissioner actually came up that ladder. Sir Charles Croswaite, the Commissioner, had to leave Burma, and Donald Smeaton officiated in his place. He asked my wife to act as chatelaine for him, and we moved to the Government House on the wall. We lived here for nearly six months, and my wife performed her duties so tactfully and well that she became a great favourite. She organized delightful picnics when she could, to which all came, and we had some unique experiences. Occasionally she entertained Burmese ladies. Surgeons Major Edge and Patterson frequently came, and the Calthorpes, and also the Rev. Gompertz, who was a great friend of mine. He had been in Allahabad with me, and was a keen sportsman. We attended many pwes or theatrical entertainments. These were carried out in a very original manner. If a person desired to give an entertainment of this nature it took place after this manner. At about 8 p.m. a man would arrive and dig a hole in the middle of the high road, in front of the house, fix a bamboo and hang lamps upon it. A little later a cart would arrive and unload the band which consisted of Burmese drums, and some horns. Then two or three women would stroll up and sit down near the pole, and commence painting and powdering their faces. These were the actresses, and were soon followed by a man wrapped in a sheet, under which he wore the dress of his part, and he chaffed and joked with the ladies. When it was dark the lamps were lighted and the band played for all it was worth, making a demoniacal noise. A crowd assembled and all would be ready. Then the host would come and sit at one end, and we were accommodated with chairs near him. The play was enacted round the central post, and every now and then a dance would be given to give the actors a rest. Our host presented silks to those who pleased him and acted well. I never understood these plays, but they seemed a little *risqué* at times. What surprised me most was the cool manner in which the public highway was reserved for the performance. No one objected and all were happy.

In the early autumn I was ordered to inspect the Ambulance Transport as far as Mogok, which was the station at the heart of the Ruby Mines. I left Mandalay and steamed to Mingon on the first night and tied up. Before darkness set in I visited the ruin of the celebrated pagoda and saw the fifth largest bell in the world. This had fallen in the midst of a confusion of jungle, and it was necessary to push branches and obstacles out of the way to approach the place. It was deserted and lonely. In front a square mass of masonry rose to a considerable height. This was the

plinth upon which a former king had designed his pagoda to be built. In front of it stood the bodies of two dragons about 80 feet to their headless shoulders; their heads had rolled into the river. Near by, the bell which was to have been erected on the pagoda lay on the earth as it had fallen. It was 16 feet or more high, and inside 14 feet to the dome, and was said to weigh 90 tons. If this pagoda had been completed it would have been a world wonder, but a fearful storm arose when it was half completed, split the plinth, and threw down the dragons and the bell. This ruin has never been touched since the storm. The Wise Men thought the omens unpropitious. Lord Dufferin was anxious to remove this bell ; then it could not be done, but it has been moved lately.

At sunrise I left and made up stream for Kyauk Myoung at the entrance to the first defile of the river. These defiles are narrowings of the river between the hills and extend for some miles. The forest trees grow to the edge of the stream and make a very beautiful scene.

The next tying up place was at Thibetkyn. At this time it was the shortest route to the Ruby Mines, but the road was difficult and dangerous. It is now the principal road. Getting under way, I was soon tired of the constant "flap," "flap," "flap" of the paddles, echoing all round, but we soon passed out of the defile into a magnificent expanse of water, with Malé on the left hand. On our right was Khanyat, where I disembarked. Here I met Davis of the K.O.Y.L.I. who took me to the stockade. Dyas of the Hampshires was the C.O. in the place of Major Vaughan, who had been cruelly done to death a few days earlier. Davis gave me a comfortable corner in his room, and then related the story of this murder.

Three days before, Davis was sitting in the shade of his hut, when Myrtle, a spaniel belonging to Vaughan, came up barking and whining in an unusual manner. He got up to comfort her when she moved off and howled again ; he followed the dog some distance along the road to a place where her master's body lay hacked in pieces with dahs. This was evidently the work of some particularly savage dacoits. Having brought the body in, the alarm was given and a prolonged search started, but with no immediate result. A woman who saw the murder stated that she saw Vaughan walking along the road with his gun and dog, overtaken by a bullock cart which passed him and then stopped. When Vaughan again passed by quite unsuspectingly, out jumped three armed dacoits and murdered him with dahs, and escaped into the thick jungle.

This ugly contretemps caused great consternation, and I did not look forward to my ride through the jungle on the next day with any great pleasure. That night Davis woke me and asked me to listen to the report a Madrassi interpreter had brought in. He reported that some dacoits were in a native quarter in the adjacent bazaar and were boasting of the murder. He consulted Dyas, who kept a strict watch till he could get some more evidence that might fix the actual murderers. His plans were eminently

successful, for two days later he caught them all. I had left Khanyat before these men were tried by Mr. Scott and sentenced to death. On their way to execution two broke away and plunged into the river. One was shot immediately, but the other got a long way out before a bullet passed through his head. The third was hanged. Murder had become rather a fine art among the Burmese, and Vaughan's end was not the only one. Joe Heath of my Service was treacherously murdered at Sagain in the same way. Heath's death was associated with a brave action. He was with another young officer who was wounded, and Heath was shot as he was endeavouring to carry him to a place of safety.

I continued my journey and, passing two small posts, reached Sagadoung at the base of the Shan Hills. The jungle became very attractive near the hills. I saw game fowl and little bantams flying wild, making a pretty picture with their magnificent colouring in the bright sunlight. Parrots and golden orioles were there, as well as large and beautiful butterflies, all in a setting of marvellous greens and browns.

It was hot and stuffy at Sagadoung and I was glad to leave and ascend the hill. The road was very steep and rough, so I rode a mule instead of giving my pony a sore back. When I reached the steep place the mule began climbing in a most uncomfortable manner, and I could hardly keep myself on its back. The saddle was slippery, so I hung on to the pommel, or I should have slid off and perhaps down the *khud* side. However, I escaped, and the same afternoon reached a choung and halted for the night.

The next morning I reached the Headquarters of the Ruby Mine Column, then commanded by Colonel Cubitt, V.C. He was very hospitable, and I remember a fine camp fire in the evening. Captain Barret was the Staff Officer, and afterwards became the distinguished Lieutenant-General Sir A. Barret, K.C.B., etc. The next day I rode to Mogok and found many hard at work washing for rubies. I got a few and returned, having completed my distribution of bearers. As it was now easy going to the plain, I did a double march to Sagadoung.

I stayed one night at Sagadoung and the following morning started for Wangtu. On my first journey I had not noticed anything beyond the dryness, and I think it was because a breeze blew in my face. It was different on the return. The sultriness was dreadful and everyone felt it. It was interesting to note the arrangements for maintaining water stations along this dry track. Each cart enters the bamboo forest with receptacles made from a bamboo stem each holding about a quart of water, hung on the back. The cart usually carries three receptacles. At the first station it takes the three left by the last cart and uses the water in them and leaves the fresh supply. Finally, each cart emerges from the forest with three empties.

This day we were all much exhausted by the march through the dry bamboo jungle with the wind behind us. Our breathing became embar-

rassed, and great was our relief when we saw the end of the forest. The path had lain through a dry dusty uninteresting forest of huge feathery bamboos shedding their seeds. The bamboos grow in clumps, and between these we had to find our way. As we emerged our road led direct to a ford over a small stream, beyond which, on a short slope, we espied the Rest House of Wangtu. We made for the ford and relieved our animals. As soon as possible I had a swim. My pony was still by the water, so I returned on his back dressed in a towel and topi and went to my quarters.

I reached Khanyat, and was at once fortunate to go on board the steamer "Alompra" and meet Captain Rimmer again. We tied up at Kyouk Myoung; Surgeon-Major Beatty came on board and asked me to dine at Mess. I gladly accepted. This was a large post and embraced officers of all kinds. The dinner was excellent. The next day I reached Mandalay without further incident.

During my absence orders had arrived for me to embark with the K.O.Y.L.I. for England as my tour of service was over, and only a few days remained for me to complete my arrangements.

Sir George White sent for me and was most generous in his remarks, and told me that he was putting my name forward and hoped I should get something. I was "Mentioned in Despatches" for the first time.

A day or two later I embarked at the Shore, and while we were waiting to push off, a man fell into the river. Colonel Chatfield in an instant was over and after him. This was a most risky and dangerous action, for the stream was swift. He was unsuccessful, as the poor soldier had gone under another boat and was drowned. The Colonel was rescued in a very exhausted condition. He commanded the Regiment, and we were proud of him.

In five days we were safely on board H.M.S. "Clive" and were on our way to Bombay.

The men in my charge had had a very severe time in the fever-stricken land of Burma. I was inundated with cases, many of a serious and fatal character. Before we reached Point de Galles, the southernmost point of Ceylon, I had three hundred and seventeen admissions and seventeen deaths. I racked my brains to devise something to stop this mortality, for it was depressing in the extreme. Not only did I treat the cases, but I had to prepare the bodies for burial at sea. I was helped by Major Milton of the Regiment, who was killed later in the South African War. I wandered among the poor fellows, as patient and smiling as ever, and satisfied myself that they were not eating their rations. Neither did we in the saloon, but we lived on cocktails. I remembered reading of Sir Samuel and Lady Baker returning from Central Africa stricken with fever and lying weak and exhausted in their boat on their way down the Nile to Cairo. They met the traveller Speke on his way up, and he came on board. Sir Samuel had run out of whiskey, and Speke gave him some, and the invalids slowly recovered. My own observations and the reading

of this story in the "Albert Nyanza," I think, decided me to recommend three issues of rum, two of which were to be taken with a pint of warm milk. Colonel Chatfield agreed, but was doubtful if the issue would be passed. The result was magical, for the men began to react immediately. We had more cases but no more deaths. The expenditure was approved by the Government of India.

On arrival at Bombay I found orders directing me to wait for five weeks for my ship; I had to hand over my charge, which was disappointing.

I landed with my wife and went to the Great Western Hotel, where I found Sir Samuel and Lady Baker arranging for a shoot in the Central Provinces. I had not forgotten my recent experiment on the strength of his remarks, and determined to call and tell him. I had also another string in that my wife's uncle, a Colonel Wyatt, knew him and had shot with him. I called, and we were invited to his table. With regard to the treble issue of rum, he said, "You did quite right—quite right," and added, "my rules for drinking whiskey are four. Drink the best whiskey—drink a physiological dose—drink it in water—and drink it after the sun has passed below the yard-arm."

A little later we determined to wait for the ship at Matheran, near Bombay. This is a very pretty place, with points of glorious scenery on the roads. My wife made several beautiful pictures of these. Major Barry was the Superintendent, and helped to make our visit very pleasant.

In January I embarked for England on H.M.S. "Crocodile."

Much amusement was caused on board by a newspaper run by the Paymaster. On the front of the paper were the arms of India, and the motto was, "Evans light our guide." The alteration was in deference to Captain Evans, R.N., who commanded the ship.

The journey was soon over, and once more we were in England; and this ended my first five years of service in India, and I loved every one of them.

(To be continued.)

Current Literature.

STREETER, H. W. **Experimental Studies of Water Purification. IV. Observations on the Effects of Certain Modifications in Coagulation-Sedimentation on the Bacterial Efficiency of Preliminary Water Treatment in Connection with Rapid Sand Filtration.** *Pub. Health Rep.* Wash. 1930, v. 45, 1521-36; 1597-623, 16 figs. [15 refs.].

The experimental studies recorded in this paper have been concerned with the effects of variations in: (*a*) the period of sedimentation; (*b*) the method of applying the coagulant; (*c*) the pH of the coagulation reaction;

(*d*) the dose of coagulant on the bacterial efficiency of rapid sand filtration. Substantial gains in bacterial efficiency resulted from prolongation of the sedimentation period up to 8 or 9 hours, but there is little gain in efficiency beyond 12 hours. Variations in the pH of the coagulation reaction from 5·6 to 6·9 produced little effect. Efficiency became sharply diminished with pH values above 7·0 and slightly improved with pH values approaching 5·5. The bacterial efficiency of double-stage coagulation, with two separate stages of sedimentation, was always greater than with single-stage coagulation with one stage of sedimentation. Single-stage coagulation using the same total dose of coagulant combined with separate stages of sedimentation yielded equally good results when the total sedimentation period was the same. There was a fairly consistent relation between the amount of coagulant added and the resulting bacterial efficiency. Measurable gains in efficiency were shown with increases of alum as coagulant up to 5 grains per gallon. M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

BIRKHAUG, K. E. **Metaphen (4-Nitro-3, 5-Bisacetoxy-mercuri-2-Cresol). I. A Comparative Study of Commonly Used Disinfectants and Antiseptics. II. Histologic Changes produced by the Intravenous Administration of Metaphen in Rabbits.** *J. Amer. M. Ass.* 1930, v. 95, 917-23. [21 refs.] [School of Med. & Dentistry, Univ., Rochester.]

Metaphen, tested in a number of different ways and against a variety of organisms, was demonstrated to be a more powerful disinfectant and antiseptic than either mercurochrome, mercuric chloride, hexyl resorcinol, tincture of iodine or phenol. It is superior also in the presence of serum. In a dilution of 1 in 120,000 metaphen kills staphylococci in ten minutes, whereas the other disinfectants require to be in much greater strengths to have the same effect. *Bact. coli* is killed by a 1 in 20,000 solution and *B. anthracis* by 1 in 40,000. When injected into normal rabbits the lethal dose is approximately 10 c.c. of a 1 in 1,000 alkaline solution (pH. 10·0), which represents about 2·3 mgm. of mercury per kilo of animal. Death is mainly due to hæmorrhagic tubular nephritis. No structural damage was demonstrated after repeated doses containing less than 1·5 mgm. of mercury per kilo. Metaphen therefore has a low toxicity and as it does not precipitate serum proteins even in a concentration of 1 in 200, it appears worthy of an extended trial in local infections and in blood-stream infections.

M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

WOLFF, L. K., OVERHOFF, J., & VAN ECKELEN, M. Ueber Carotin und Vitamin A. [**Carotene and Vitamin A.**] *Deutsch. med. Woch.* 1930, v. 56, 1428-9. [Hyg. Lab., Univ., Utrecht.]

The authors confirm the results of previous workers that carotene can cure the symptoms produced by a vitamin A-free diet. At the same time,

they were able to show definitely that carotene and vitamin A are not the same, but that the former is changed into the latter in the animal body. Four rabbits were kept on a diet-free vitamin A and carotene, and a small piece of liver was removed from each animal and tested for both substances. The animals then received an injection of 1·8 mgm. of carotene and after 3 days a marked rise in the liver content of both vitamin A and carotene was found to have occurred. The authors were able to separate vitamin A and carotene by shaking a petrol ether solution of the two with 90 per cent. alcohol. Vitamin A goes into the alcoholic layer, while carotene remains in the petrol ether. A number of plant and animal extracts were examined for their relative contents of vitamin A and carotene. Plants were found to have little or no vitamin A but much carotene. In animal products the two occur together except in liver, which generally contains only vitamin A. DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

BURNETT, F. M., & KELLAWAY, C. H. **Recent Work on Staphylococcal Toxins, with Special Reference to the Interpretation of the Bundaberg Fatalities.** *M. J. Australia.* 1930, v. 2, 295-301. [4 refs.] [Walter & Eliza Hall Inst., Melbourne.]

In a report of the Royal Commission on the Bundaberg disaster of January, 1928, in which 12 of 21 children died after injection with the contents of a particular bottle of diphtheria toxin-antitoxin mixture and 6 others became severely ill, it was shown that the bottle in question was heavily infected with *Staphylococcus aureus*, and that the children died from an acute infection with this organism. The fulminating nature of the illness—the 12 deaths occurred within a few days after the inoculation —suggested an acute toxæmia rather than a staphylococcal infection of the usual type. This led to an extensive series of experiments on the properties of the staphylococcal toxin. Certain of the results obtained have already been published elsewhere (BURNETT, F. M., this *Bulletin*, 1930, v. 5, 31, 404). In the present paper the authors review these findings and add some interesting notes on the pharmacological action of the toxin, which will shortly be published in a more complete form.

One of the most striking characteristics of the toxin is the rapidity with which it kills the rabbit, an animal which is peculiarly sensitive to its action. After the intravenous injection of a moderately large dose a rabbit may die within two minutes.

Experiments showed that the immediate cause of death after such intravenous injections was a rapid circulatory failure. Blood pressure tracings in the intact animal showed first a slight fall, a subsequent rise to, or above, the normal level, and then, from thirty to sixty seconds later, a rapid and progressive fall almost to zero. By inspection of the intrathoracic organs in an anæsthetized animal, and by the use of heart-lung preparations, it was shown that one of the important factors concerned

was an increase in resistance to the circulation through the lung, presumably due to a contraction of the pulmonary arterioles. After the injection of the toxin there was a rapid rise in the pulmonary pressure associated with a great diminution in the output from the pulmonary vein. Experiments on the isolated heart showed that there was also a direct weakening action on the heart itself.

The action of the toxin can be entirely inhibited by a specific antitoxin; but such an antitoxin does not protect an animal from a fatal septicæmia, following the injection of living staphylococci. W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

MIESCHER, G. **What protects the Skin against Light.** *J. State Med.* 1930, v. 38, 387-91.

It has been supposed that the diminished sensitiveness of the skin to light is to be attributed to the pigmentation which occurs after repeated exposures. But the congenital hyper-pigmentation of the negro gives much less protection against light than the pigmentation arising after exposure to light rays; and the completely depigmented areas of skin in vitiligo can develop a desensitivity to light. Further it has been shown histologically that the chief changes in the light reaction occur in the Malpighian layer, which is superficial to the basal pigmented layer. Many hypotheses have been introduced to explain why there should be differences in light sensitiveness between various areas in the same individual apart from pigment or other noticeable factors. The author has found that the differences are explicable by variations in the thickness of the *stratum corneum* of the skin, so that skin areas in which the horny layer is 10-20 μ [misnamed π in the text] in thickness, are highly sensitive to light, whereas on the palms and soles, where the *stratum corneum* may be 150-500 μ thick, it is practically impossible to obtain a light reaction. There is a direct relation between the degree of decreased sensitivity and thickness of the horny layer. Mucous membranes, since they have no *stratum corneum*, are highly sensitive to light. The absorptive substances which are components of keratin are such amino-acids as phenyl-alanine and tyrosin, which absorb the erythema-productive ultra-violet rays, as does also quinine. Cystin, which is an important constituent of keratin, is also highly absorptive. When a spotted pigment area of the skin is rayed with large doses, the pigmented and non-pigmented epidermis is equally injured, but under the pigmented part of the epidermis, the connective tissue of the cutis is quite uninjured, whereas under the non-pigmented epidermis there is destruction deep into the cutis. "The pigment layer is therefore the sunshade for the cutis, just as the horny layer is the sunshade for the epidermis." But the light function of pigment is not in this manner exhausted, for it also prevents an undue amount of heat from entering the body, owing to its absorption of long-waved visible and infra-red rays. R. G. BANNERMAN.

Reprinted from "Bulletin of Hygiene," Vol. 6, *No.* 1.

Furniss, A. **Some Ultra-Violet Ray Dangers and their Avoidance.** *Med. Officer.* 1930, v. 43, 294-5.

There are a number of diseases which should not be treated by actinotherapy, including those conditions in which there is a congenital hypersensitiveness to light and also such diseases as acute nephritis, severe arteriosclerosis, grave heart disease and Addison's disease. Accidents with apparatus are accountable for some dangers; bursting of a quartz burner is extremely rare, but if a breakage should occur it is important that the windows of the treatment room be opened to allow escape of the poisonous mercury vapour. Sparks from metal electrodes of an arc cool quickly and give rise to no danger provided the patient is at a sufficient distance from the lamp. Ozone may be produced in considerable quantity by the mercury vapour lamp, and while in some cases desirable it may arouse nausea and vomiting in persons hypersensitive to it; proper ventilation of the treatment room is indicated. Ocular troubles in patients and operators can of course be avoided by the wearing of goggles, and it is essential that these should be opaque to the rays right up to the border of the orbit—the chauffeur goggles type. When using an arc lamp it is necessary to protect the retina against infra-red as well as ultra-violet rays. The conjunctivitis due to ultra-violet exposure can be treated by ice packs and boric acid douches or the use of silver preparations.

Erythema is not so readily produced in infants as in older children and adults. The more severe degrees may be treated by such preparations as vaseline and zinc oxide ointment. Importance is to be paid to the fact that excessive light exposure may reduce the blood pressure with consequent symptoms of malaise. The delayed type of accident occurs especially in the tuberculous patient and small dosage should be the rule to avoid extension of the disease. R. G. Bannerman.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 1.

Reviews.

An Introduction to Malariology. By Mark F. Boyd. London: Humphrey Milford, Oxford University Press. 1930. Pp. xiv + 437. Price 25s. net.

The author presents in a concise volume of some 437 pages what is practically an epitome of the enormous mass of work carried out in researches on malaria during the past twenty years.

The book is divided into five sections, of which two deal with the ætiology of the disease itself and with the bionomics of the anopheline carriers. The remaining chapters include malaria and mosquito surveys and their relation to control work.

Of these sections the best, perhaps, is that on the Natural History of

Malaria, for here there are excellent presentations, in their relative importance, of the many and varied factors which tend to allow of infection in any community.

In the second section the question of spleen and parasite rates is discussed clearly and well. The chapter dealing with the anopheline mosquitoes contains much valuable information as to their distribution, behaviour and breeding habits under varying conditions of climate and topography.

The illustrations and diagrams in the text are clear and accurate.

We have nothing but praise for this volume, which is well printed and of convenient size, and which must assuredly take a high place in the literature of the subject. It is a book which will become essential to workers on malaria not only in America but in all parts of the world.

BAILLIÈRE'S SYNTHETIC ANATOMY. Parts VII and VIII. By J. E. Cheesman. London: Baillière, Tindall and Cox. 1930. Price 3s. each net.

This series, as many of our readers know, consists of collections of anatomical drawings on sheets of transparent tissue so arranged that structures may be followed in their relations in successive planes throughout their course. As aids to the study of anatomy for the student or to the surgeon who wishes to refresh his memory their value is obvious.

The two parts now published include the thorax and abdomen, twelve coloured drawings to each, and the binding has been arranged so that the corresponding sheets for thorax and abdomen can be placed in an interlocking position to form the complete trunk.

These complete the survey of the body in the antero- and postero-lateral aspects, and the only remaining parts to be published are those of the brain and male and female perinæum, which will be dealt with from above and below.

THE TREATMENT OF ASTHMA. By A. H. Douthwaite. London: H. K. Lewis and Co., Ltd. 1930. Pp. viii + 164. Price 7s. 6d.

In a handy volume of some 160 pages Dr. Douthwaite presents an epitome of modern views on this puzzling syndrome.

The first portion of the volume is devoted to a discussion of the ætiology of different clinical asthmatic states, and the author draws a very clear distinction between primary and secondary bronchial asthmas with their accompanying biochemical pictures. After a full discussion of the actual paroxysm and its treatment, the writer passes to the most useful part of his book—the management of the asthmatic between attacks with a view to amelioration of an otherwise progressive condition.

Dr. Douthwaite has dealt admirably with the whole subject in a short compass, and every medical man will welcome this addition to his library.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LISTS OF BOOKS RECEIVED DURING THE PERIOD JANUARY 1 TO MARCH 31, 1931.

Authors	Title of Work	Grant or Gift
Ministry of Health ..	Vaccination—Further Report of Committee..	Ministry of Health
Gibson	Mycoses of the Spleen	Library and Journal Committee
Strecher & Ebaugh ..	Practical Clinical Psychiatry for Students and Practitioners	Grant
Flagg	The Art of Anæsthesia	,,
Wood & Lawall ..	The Dispensatory of the United States of America	,,
Cecil	A Textbook of Medicine	,,
Davis (Muller) ..	Applied Anatomy..	,,
Rawling	Stepping-Stones to Surgery	,,
Clifford & Mottram ..	Properties of Food	,,
Oman	Peninsular War. Vol. VII	,,
Crookshank	Epidemiological Essays	,,
Chandler	Introduction to Human Parasitology ..	,,
Beckman	Treatment in General Practice	,,
Zarotshenzeff	Between Two Oceans—Rapid Chilling and Freezing Systems for Fish and Meat	,,
Bailey	Emergency Surgery. Vol. I. Abdomen ..	,,
Hegner & Andrews ..	Problems and Methods of Research in Protozoology	,,
Terrill & Ulrey ..	X-ray Technology	,,
Kerrison	Diseases of the Ear	,,
Cowderoy	Pocket Notes and Remembrancer	,,
Paterson	Sick Children, Diagnosis and Treatment ..	,,
Stewart & Dunlop ..	Clinical Chemistry in Practical Medicine ..	,,
Walton	A Textbook of Surgical Dyspepsia	,,
Leitch	Dietetics in Warm Climates	,,
Levine & Schoelin ..	A Compilation of Culture Media	,,
Romanis & Mitchiner ..	The Science and Practice of Surgery. 2 vols.	,,
Bowlby & Andrews (Keynes)	Surgical Pathology and Morbid Anatomy ..	,,
Winton & Bayliss ..	Human Physiology	,,
Mitchell	Recent Advances in Analytical Chemistry. 2 vols.	,,
Partridge	Aids to Bacteriology	,,
McKittock & Root ..	Diabetic Surgery	,,
Stedman	Medical Dictionary	,,
Cabot	Physical Diagnosis	,,
Imms	Recent Advances in Entomology	,,
Poynton & Schlesinger..	Recent Advances on Rheumatism	,,
Eyre	Bacteriological Technique..	,,
Allens	Commercial Organic Chemistry. Vol. VIII.	,,
Churchill	Medical Directory. 1931	,,
India Office	Fauna of British India. Vol. II. Cestoda	India Office
Stallybrass	The Principles of Epidemiology	Grant
Smith & Glaister ..	Recent Advances in Forensic Medicine ..	,,
Halliburton & McDowall	Handbook of Physiology	,,
Whitman	Orthopædic Surgery	,,
Badcock	Textbook of Surgery	,,
Cheesman	Baillière's Synthetic Anatomy. Pts. 4, 7, 8, 9a	,,
Crawford	Roll of Indian Medical Officers	,,
Pickett-Thomson ..	Annals of Research Laboratory. Vol. VI ..	Library and Journal Committee
Ghosh & Stewart ..	A Treatise on Hygiene and Public Health ..	Grant
Mackie & McCartney ..	An Introduction to Practical Bacteriology ..	,,
Glaister & Glaister ..	A Textbook of Medical Jurisprudence and Toxicology	,,
Pye (Carson)	Surgical Handicraft	,,
Bourne	An Introduction to Medical History and Case-taking	,,
Henry	Exposures of Long Bones and Other Surgical Methods	,,
Marshall & Piney ..	A Textbook of Surgical Pathology	,,
India Office	Fauna of British India. Vol. II. Coleoptera	India Office
Medical Research Council	A System of Bacteriology	Grant

Correspondence.

THE FIELD AMBULANCE—AN ALTERNATIVE NAME?

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I suppose everyone has heard the expression, "She drove a Field Ambulance in France during the War" or variations of it used at one time or another. I have taken the actual phrase from a newspaper report of a case of a lady charged with shoplifting. It was part of the defence. It is curious that a word which implies literally something that "walks," without any reference to hospitals, surgical aid or the injured, should have come to mean what it does. But the fact remains that "An Ambulance" to the general public is a vehicle for the conveyance of injured persons to hospitals, and this being the case, it has become necessary to consider whether an alternative for the name "Field Ambulance" is not now advisable, to avoid confusion in the minds of others.

There are quite a number of possible alternatives. The old title of "Field Hospital," which was abandoned when the independent bearer companies were amalgamated with the mobile hospitals, would appear to be a good one. It has, however, a number of objections, the principal one again lying in the minds of the general public. The meaning of "hospital" has also become fixed, and cannot be dissociated from such things as wards, beds, white paint, glazed tiles, nurses, flowers and charitable lady visitors carrying presents of fruit, hymn books and the works of Charles Dickens. One can picture a rather ill-informed journalist, after a visit to a hastily improvised "Field Hospital" during a war of movement, comparing later in print "A typical *Military* Hospital" most unfavourably with St. Bartholomew's or St. Thomas's.

Amongst other names suggested are "Divisional Medical Train," and variations of the latter, such as "Field Medical Train," or simply "The Medical Train." All these have very obvious objections. The first is too vague and comprehensive, and logically would refer to all medical troops in the Division, and it would also be liable to confusion with the Divisional Supply Train. "Medical Train" would be confused with "Ambulance Train."

The best alternative seems to be the term "Company" in some form, the only possible objection being that field ambulances are now already subdivided into companies instead of sections, but the latter form could be reverted to.

"Field Medical Company," or rather more euphoniously "Medical Field Company," is a compact descriptive title," or the name "Field Company R.A.M.C." might be adopted, though the addition of the word "Cavalry" to any of the above, results in a rather cumbersome combination.

It is true that the above names are less descriptive of the functions of a field ambulance than the present one, but this is more of an advantage than the reverse. When a field ambulance is open, it is known to those whom it concerns as a dressing station or a reception station, and when it is closed, it *is* closed, and the fewer stray visitors that find their way to it the better.

I am, etc.,

C. L. EMMERSON,
Major, R.A.M.C.

Notices.

CONGRESS OF THE ROYAL SANITARY INSTITUTE.

THE Forty-second Congress of the Royal Sanitary Institute will take place at Glasgow, from July 4 to 11 next, under the Presidentship of Sir Henry Mechan, D.L., LL.D.

The annual congresses organized by the Institute are recognized as the most important gatherings in the cause of public health; the large field covered by the work of the Congress is indicated by the following subjects which are to be discussed :—

- The Rôle of the Hospital relative to the Development of Preventive Medicine.
- Proposals of the B.M.A. for a General Medical Service, from the Standpoint of Preventive Medicine, and in Relation to National Health Insurance.
- Development of the National Health Insurance Scheme.
- Administration of the Local Government Act, 1929.
- Legalizing Eugenic Sterilization.
- Health Certificates before Marriage.
- Pregnancy and Tuberculosis.
- Maternity and Child Welfare Work.
- The Pre-School Child.
- Infant Welfare Schemes.
- Teaching of Mothercraft.
- Port Conditions as Affecting the Mercantile Marine.
- Ventilation as a Prime Factor in Industrial Hygiene.
- Dietary Studies.
- Biology and Hygienic Principles of Bread-making.
- Control and Disposal of Unsound Food.
- Bacterial Contamination of Milk.
- Repeal of the Milk Regulations, 1901.
- Closure of Private Slaughter-houses and Compensation Payable.
- Air Purification.
- Hospitals—Planning and Construction.
- Provision and Planning of Working-class Dwellings.
- Clyde Valley Regional Planning Scheme.
- Housing.
- Slum Clearances.
- Discharge of Sewage into Sea.
- Municipal Engineering and its Implications.
- Single Pipe Drainage.

Major Walter Elliot, M.P., LL.D., D.Sc., M.B., will deliver the lecture to the Congress on "A Continuous Health Policy," on Friday, July 10.

An attendance of about 1,400, consisting of delegates, members of the Institute, and visitors, is expected. The following foreign and Dominion Governments, &c., have already appointed delegates, and it is anticipated that many more will be represented : International Labour Office of the League of Nations, South Australia, Canada, Bihar and Orissa, United Provinces, Calcutta (India), Johannesburg, Port Elizabeth (South Africa),

Southern Rhodesia, Sierra Leone, Lagos (Nigeria), Singapore, Hong Kong, United States of America, Dominican Republic, Amsterdam.

A large Health Exhibition has been arranged in connection with the Congress, which will include such exhibits as Infant and Invalid Foods, Household and Kitchen Appliances, Hospital Appliances, Sewage Disposal Apparatus, Refrigerators, Gas Stoves and Fittings, Disinfectants and Disinfecting Apparatus, Soap and Sanitary Appliances.

The Right Hon. The Lord Provost of Glasgow is the Chairman of the Local General Committee; the Town Clerk and the Medical Officer of Health are acting as the Honorary Local Secretaries.

CHADWICK PUBLIC LECTURES, 1931.

THE Nineteenth Annual Series of Chadwick Lectures was inaugurated on Tuesday, February 24, at 8 o'clock, at the Royal Sanitary Institute, Buckingham Palace Road, when Mr. E. A. Elsby, B.Sc., A.I.C., holder of a Chadwick Travelling Scholarship, 1929-30, discussed the grave problem of Silicosis as an Industrial Disease.

The Spring Programme included a Lecture on Maternal Mortality by Dame Louise McIlroy, M.D., on Wednesday, March 11, and a Lecture by Professor Major Greenwood on "Nerves and the Public Health," in the Great Hall of The British Medical Association, on Thursday, March 26. "Nervous" illnesses were considered in relation to industrial lost time and the psychological revolution work of the Industrial Health Research Board.

On Friday and Monday, May 15 and 18, at 8 o'clock, at the Institution of Mechanical Engineers, Storey's Gate, Professor E. L. Collis, D.M., of the Welsh National School of Medicine, will give two discourses illustrated by lantern slides on "The Coal Miner: his Health, Occupational Diseases and Welfare." The last Spring Lecture will be on Thursday, June 4, and Mr. T. F. Chipp, M.C., Ph.D., D.Sc., Assistant Director of Kew Gardens, will be the lecturer on "Trees and Man."

All Chadwick Lectures are free and no tickets are required.

Further information as to dates, subjects, etc., may be obtained of Mrs. Aubrey Richardson, O.B.E., at the Offices of the Trust, 204, Abbey House, Westminster.

"WELLCOME" BRAND DIPHTHERIA PROPHYLACTIC T.A.F.

DIPHTHERIA PROPHYLACTIC (Toxoid-Antitoxin Floccules) is prepared at The Wellcome Physiological Research Laboratories, Beckenham, Kent. When toxoid and antitoxin are mixed, floccules are formed which retain the immunizing power of the toxoid. Removal of the supernatant liquid allows 99 per cent of the nitrogenous bodies present in the broth after growth of the bacilli to be discarded, with a consequent diminution of the tendency of the preparation to cause undesirable reactions. It is claimed that with the low liability to cause reactions "Wellcome" Brand Diphtheria Prophylactic T.A.F. shows unusually high immunizing power.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C. 2.

VOL. LVI. JUNE, 1931. No. 6.

Journal

of the

Royal Army Medical Corps.

Original Communications.

A DISCUSSION ON MALARIA IN THE QUETTA-PISHIN DISTRICT.

BY MAJOR R. A. MANSELL, M.B.E.,
Royal Army Medical Corps.

[THE histograms for the years 1927, 1928 and 1929, which accompany this paper, have been compiled from records left by my predecessor (Major R. Davidson, R.A.M.C.).

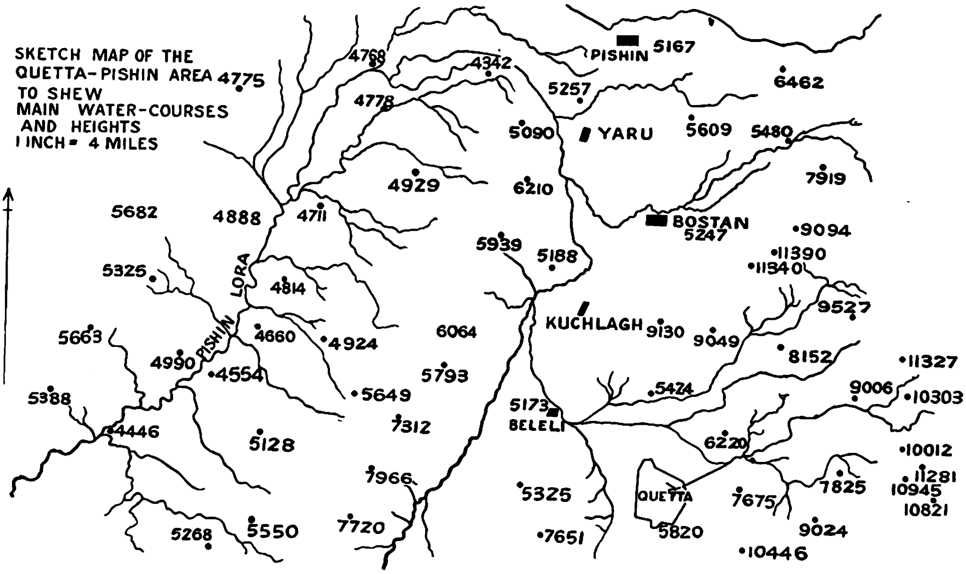
The meteorological data are taken from the Government of India's published records and reports.]

Quetta stands, at an average height of 5,500 feet above sea-level, in the mouth of a valley lying to the south-east of the Quetta-Pishin District. This district consists, broadly, of a series of more or less precipitous, barren mountain ranges which run north-north-east to south-south-west and enclose long alluvial valleys varying in width from two to twenty miles. The mountain ranges consist, each, of steep stony slopes rising rapidly to long spurred ridges of an average height of 7,000 to 8,000 feet, with occasional peaks reaching to over 10,000—the highest to 11,738—feet above sea-level.

Some miles to the north of Pishin, which itself is thirty-two miles by road from Quetta, the drainage slopes run towards Afghanistan; the great majority of the remainder of the district drains, via the Pishin Lora, in a south-westerly direction. A little to the north of Pishin the largely if not wholly

artificial lake of Khushdil Khan feeds an irrigation canal system towards the west. The Pishin Lora runs, for the most part, in a wide channel between deep banks; where possible this stream supplies irrigation water to the neighbouring country. From the Zarghun range, which rises some fifteen miles north-east of Quetta and contains the highest peak in Baluchistan, there flows the stream which supplies the drinking water of Quetta; this stream irrigates many fertile farms in the Hanna valley through which it passes finally to supply irrigation water to the cantonment, aided by the flow from subsidiary valleys.

Most of the remaining cultivated area in the district is immediately dependent on the winter rains and snow, and on the water obtained



from karezes. These karezes are, in fact, underground irrigation channels. They are constructed and maintained, I understand, mostly by a class of people who follow this work as a hereditary occupation. The karez is started, I am told, from a point in the valley at which water outcrops, or appears likely to do so. From this point an ever-deepening channel, in ordinary cases some two feet broad at its base, is dug backwards towards the source of water in the hills. When the channel becomes too deep for its sides to support themselves, it is converted into a tunnel; this is constructed by the simple process of following the direction of maximal water flow along the base of the sub-soil level. At frequent intervals along the course of this tunnel shafts are sunk from the surface, both tunnel and shafts being, ordinarily, only sufficiently large to permit the passage of

a man. Hands, ropes, wicker baskets or sacks and the crudest form of windlass are the implements of work; and only in the very largest karezes is any form of reveting or masonry to be found. The tunnel extends usually up to the origin of the true mountain from the foothill, and may be several miles in length. The shafts in Quetta of a karez which runs through the cantonment are nearly eighty feet in depth. Forming, as they do, the main sources of water for large tracts of country, these karezes are jealously guarded, valuable property; their owners possess no mean knowledge of the influence of proposed new tunnellings in the vicinity of the line followed by their own stream.

The climate of Quetta itself is rather more severe than that of the majority of the valleys which form the district. Pishin, for instance, is practically 500 feet nearer sea-level than Quetta; and the higher lands are occupied only in the warm weather by nomads. Chart I shows the figures given by the meteorological department as the "normals" for Quetta, and explains the matter more accurately and succinctly than any verbal description. A comparison of this chart with those for each of the four years given will show, however, that "quite exceptional" weather is as common in Quetta as elsewhere in the world. The outstanding features of the climate are, briefly, the large diurnal and annual variations of the temperature, the low rainfall and the relative humidity.

The soil, generally, is light and porous and, with a little care, is amazingly fertile. Natural vegetation, except in the immediate vicinity of the comparatively few permanent waters, does not occur. The winter rains and snow provide water for the crops, which, in favourable years, may be abundant, and also nourish the orchards. But the general aspect of the country during the greater part of the year is that of a place burnt dry by the sun, blown bare by the wind, and of an all-pervading sandy dust colour.

One of the most important results of all these factors is that, except in the permanently flowing channels—and these are few—water supplied for irrigation or other purposes disappears into the ground with amazing rapidity. An irrigation channel which has been running full for several hours will dry completely within an almost equal time after the flow has stopped; the same thing will occur even throughout the length of a fairly extensive road culvert, unless, of course, this is bricked or cemented. Quetta is a place where to cement the water channels is to handicap the anti-malaria worker; and the constant problems for such a person in Quetta cantonment itself are the bricked siphons carrying irrigation water under the main roads, a few areas in close relation to the main, continuously flowing, irrigation channel, the water supply reservoirs and—as ever—the taps which some leave permanently open in order to obtain the maximum value from their gardens.

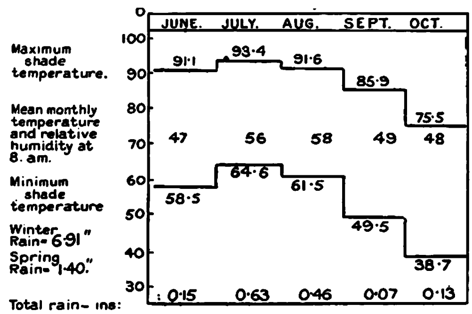


Chart I.

On the same scale as the following Charts, showing, diagrammatically, the mean monthly meteorological normals for Quetta.

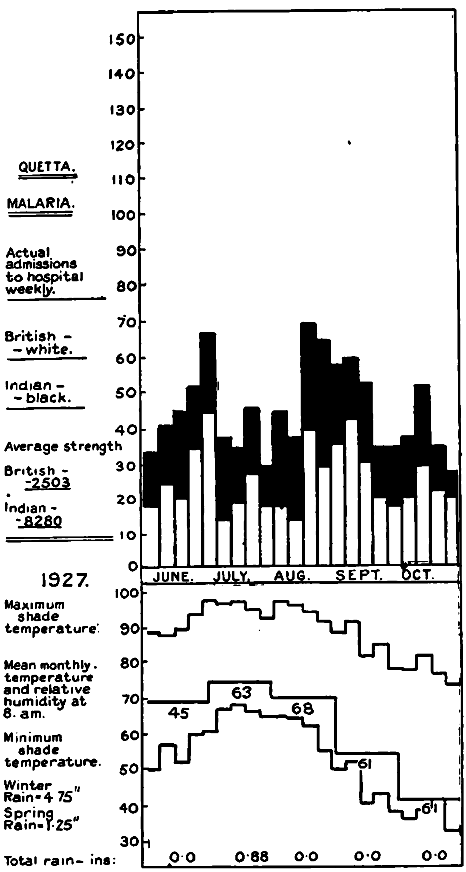


Chart II.

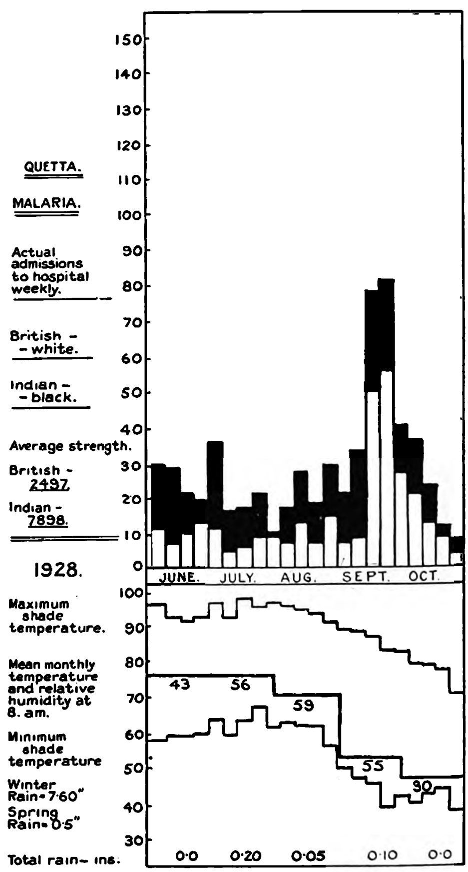


Chart III.

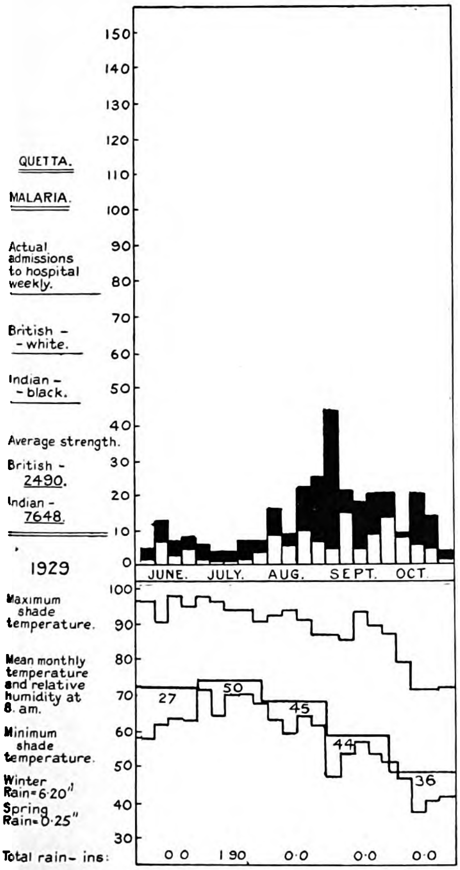


Chart IV.

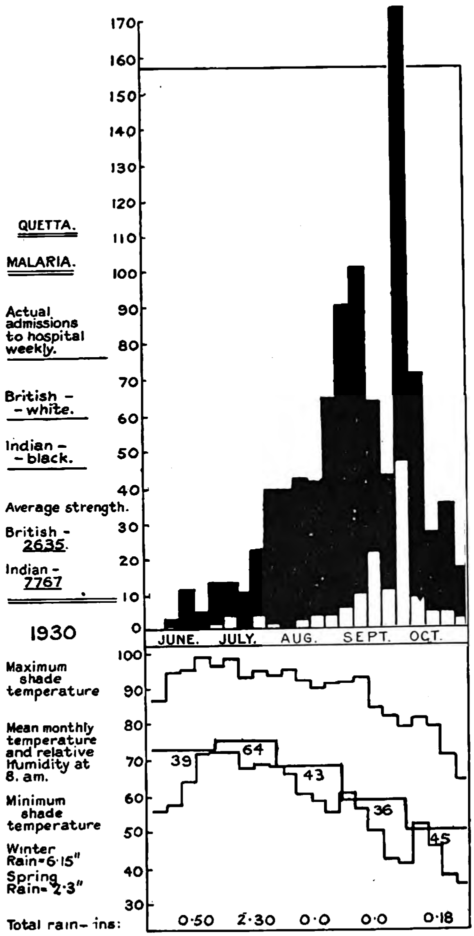


Chart V.

The following anophelines are recorded to have been found in, and near, Quetta; the malaria-carrying potentiality of each is shown :—

A. culicifacies	+	+	+
,, *jeyporensis*	?	?	?
,, *lindesaii*	?	?	?
,, *listonii*	+		
,, *multicolor*	?		
,, *pulcherrimus*	?	?	
,, *rhodesiensis*	?	?	
,, *stephensi*	+	+	+
,, *subpictus*	?	?	?
,, *superpictus*	+	+	+
,, *turkhudi*	?	?	?

In the Punjab and the North-west Frontier Province I have always had very serious doubts regarding the practical utility of the so-called

"species sanitation," as I have found as many as four species, of reputedly widely different habits, breeding together in waters of qualities varying from every point of view, and I am certain that at the height of the breeding season at any rate, all waters must be suspect of harbouring all or some species. I have not sufficient experience of the matter to venture an opinion whether this holds good for Baluchistan. There is here an opportunity for useful research.

Does *A. stephensi* inhabit karezes; or is the running water therein unfavourable to this species?

Does, in fact, any species commonly breed in karezes, except near their outlets; or is the depth and coldness of these places inimical?

What is the temperature of karez water at, say, twenty to eighty feet under the ground surface at different times of the year?

What is the breeding value of the highly saline tributaries of the Pishin Lora as regards different species; and, if they breed freely therein, how is their infectivity affected?

How, if at all, does the spleen rate in villages near these saline waters differ from that of villages in other parts of the district similarly related to water of other qualities?

What is the effect of such a dry climate on the parasite-carrying power of the species?

The questions which can be asked, to which there are, at present, no sound answers, are innumerable; and in suggesting them, I am well aware of the attacks against which I am defenceless; but the answers to most, if not all, of them, have a definite value in the prevention of malaria on this plateau. I can only plead that the experience of a single season, without any previous knowledge of the somewhat peculiar local conditions, and without previously existing organization for dealing with such special problems, is insufficient to base any useful replies to these particular questions.

Taking such facts as are known:—

Malaria is endemic on the plateau, and it may, in seasons favourable to it, appear with epidemic vigour.

In the city and cantonment of Quetta itself, mosquito breeding—to any dangerous extent—is not normally common on account of the interrupted nature of the irrigation water supply, the low relative humidity, the porous nature of the soil and the sparse vegetation, whereby residual pools rapidly dry up; with the proviso, of course, that some anti-larval measures are in force.

In the surrounding country, wherever there is a constant water flow, with consequent marginal vegetation, mosquito breeding between—roughly—mid-May and mid-September occurs freely, in some places intensely. The places where a constant water flow is most commonly found are the neighbourhood of villages and orchards. During the warmer months malarial infection may easily be contracted on one evening visit

to such spots, as not a few moonlight picnickers in the Hanna valley know to their cost.

Turning now to the charts, and considering first the actual incidence of malaria shown thereon.

The high early incidence in 1927 may reasonably be assumed to be the aftermath of an epidemic in 1926. That epidemic was associated—at least—with extensive manœuvres undertaken relatively early in the season (August-September), and in a season of unduly high relative humidity and night temperature.

The marked rise recorded amongst British troops in September, 1928, was associated with a camp sited in close proximity to a large village. A similar camp was held at the same time of the year in 1929, but on a site removed some two miles, or more, from the village. Other factors, no doubt, played their part, but I personally (though I was not there) hold the first site, in this particular instance, to have been the main one.

On 1929 there is, at the moment, no comment to be made.

In 1930 the rise of incidence amongst Indian troops in August was associated with the necessity for the establishment of a camp in the Hanna valley to repair damage done to the water supply mains and to the road by a spate in July of uncommon volume. Following this is seen one of the results of the floods in Sind which were caused by the bursting of one of the banks of the Indus. Sappers and Miners were sent from Quetta to Shikapur to assist in the repair of the single railway line which connects Quetta with India. Had facts been known at the time which came to light later regarding the local distribution of malaria-carrying mosquitoes, and had the instructions which were issued for the immediate early treatment with quinine of these men on their return to Quetta after a fortnight's duty at the flooded area not miscarried, this rather severe outbreak should not have occurred. The sudden rise among British troops at the beginning of October was the result of certain leaks in the neighbourhood of a water reservoir situated in close proximity to the barracks of a British battalion. These leaks resulted from action taken by the military Engineer Services to try to clear up an unsatisfactory bacteriological condition of the drinking water supplied from, or through, that reservoir, which had persisted, in spite of other measures, since the July spate. Though these collections of water were noted, they did not, for one reason or another, receive any active anti-larval treatment—it was said that no larvæ could be found—yet a spot map of cases was sufficiently certain indication of the source of infection, and the simultaneous treatment of these pools and the removal of the battalion to training camp put, as the chart shows, a rapid end to the infections. The rise shown at the same time amongst Indian troops was more prolonged and was definitely confined to two battalions which had, during the first three weeks of September, occupied camp sites some fifteen miles out of Quetta in close relation to a large village. Two other Indian battalions and one British

battalion were in camp in the same area at the same time, but were located one and a half miles and upwards away from the village; these units did not produce any instances of malarial infection.

Turning now to the meteorological data.

The quantity of winter rain and snow (November to March), and therefore, to a large extent, the quantity of local irrigation water available throughout the summer, does not appear, in these few years, to have been a factor of any real importance. Nor can it really be held, taking the other factors already noted into account, that the spring rains (April and May) had any marked influence in the matter; though it is suggestive that in both 1927 and 1930 the incidence of malaria was considerable. The types of curve exhibited in the charts for these two years, however, are so grossly dissimilar that the possibility of such a common factor being decisively operative is not great.

From the year 1927 it would appear reasonable to suggest that a high relative humidity continuing above the normal is to be associated with a continuously high incidence of infection. This is in accordance with accepted theories and with facts relating to the bionomics of mosquitoes. But there have to be considered with this broad general factor the detailed habits of these insects; and it is here, apart from the obvious fact that larger quantities of water provide more extensive breeding grounds, that the rainfall enters into the problem. An excessive rainfall, such as occurred in July, 1930, results in comparatively excessive vegetation along water channels, in thicker and more extensive crops, and in a general increase of shelter for such insects as mosquitoes. Though, as in 1930, the recorded relative humidity in the succeeding months may be even lower than the average, yet in and near excessive vegetation along running water courses, the local relative humidity remains sufficiently high to make such shelter a safe resting place for mosquitoes by day; by night, as the air temperature falls, the drying power of the air decreases and does not endanger the life of the mosquito or of its contained parasites. This factor, though I have not yet found it stressed in print, is, I am convinced, one of the utmost importance; it is a most powerful reason for the clearing of undergrowth from the immediate neighbourhood of all water.

At no time in the years under consideration does the maximum shade temperature rise to a point at which it might, of itself, be inimical to mosquito life. Nor in the few curves recorded does there appear to be any feature, or combination of features, which bear a constant relation, or, indeed, a casual one, to the histograms above them—save, of course, the decline at the end of the period. This decline, however, is more suitably, and probably more truly, related, by general consent, to the curve of minimum temperatures.

The year 1927 is complicated, as has been noted above, both by being the successor of an epidemic period and by the persistence of high relative humidities. It does, however, beginning in the third week of August,

suggest a factor now to be mentioned. The September rise in 1928 has already been adequately explained on the ground of locality; nevertheless it forms an exception of definite value as a criticism. Excluding the peak of incidence in Indian troops in August-September, 1930, which was derived from the Indus floods in Sind and not from Baluchistan, such rises as appear in the periods August, September, October—(1928 excepted)—can be definitely related to a minimum temperature increased above the normal during a period preceding their occurrence by some ten to twenty days (an average incubation period); in some instances—1927—the duration of this rise is prolonged; in others—1929, 1930—it lasts only for a week or less.

We may now, tentatively, generalize, recognizing that as records become more complete truer deductions may be made from them.

The months of June, probably, and July and August, certainly, are malarious on the Baluchistan plateau up to an altitude of at least 6,000 feet above sea-level; the lowest of the camps referred to in the Hanna valley in July, 1930, was at 6,200 feet. This district is especially malarious in areas uncontrolled by any anti-malarial activity.

The month of September may also be malarious—using the word to signify that the infection may then be contracted, though it may not become evident up to three weeks later—if the night temperature remains unduly high, even for a short period, and in direct proportion to this factor.

The persistence of a high relative humidity will probably mean a similarly increased liability to infections; but the occurrence of rain during the summer to such an extent as to produce lasting vegetation in excess of the normal will counteract a consistently low relative humidity, on account of local conditions immediately favourable to the continuance of mosquito life.

The neighbourhood of villages is particularly dangerous from the point of view of malaria infections, whether or no other factors are also assisting. This danger persists well into September in any case; though at that time an area equally irrigated and with equal vegetation less than a mile away will probably not be dangerous provided that the night temperature does not exceed the normal.

REPORT ON A TRIAL OF PLASMOQUINE AND QUININE IN THE TREATMENT OF BENIGN TERTIAN MALARIA.

By Major J. A. MANIFOLD, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 338.)

Effects of the Treatment on Splenic Enlargement.

Brosius (1926), Baermann and Smits (1927), and Manson Bahr (1927) (*a*), have recorded their opinion that plasmoquine rapidly reduces the size of the spleen. Green (1929) found that in both subtertian and quartan cases of malaria enlarged spleens were reduced in size more rapidly in his plasmoquine plus quinine-treated series than in his quinine-treated controls.

Sinton, Smith and Pottinger (1930) state that the spleen rate in their series of cases was 25 per cent before the commencement of treatment, and in no case was splenic enlargement detected after completion of treatment. They did not find, however, that the rate of decrease was more rapid amongst their plasmoquine series than among the controls.

A few details have been given by some hospitals on this point.

Hospital 1 states : Of the 121 cases treated, 62 had spleens enlarged up to plus 2 on admission. In all these cases the splenic enlargement had disappeared on completion of treatment. Thirteen cases with splenic enlargement varying from plus 3 to plus 5 showed very little reduction in the size of the spleen on completion of treatment.

Hospital 2 (91 cases treated). Treatment was highly successful not only in the prevention of relapses, but in diminishing enlarged spleens. Thus, of 31 cases of enlarged spleen before treatment, only 4 remained palpable on completion of treatment.

Hospital 3 (20 cases treated). The spleen in some of the cases diminished in size remarkably quickly, but in others the drug appeared to have had no effect on the spleen (details not given).

Hospital 4 (253 cases treated). In cases of benign tertian, fresh infection with palpable spleen, the effect of the combined plasmoquine and quinine treatment is practically the same as that of the ordinary quinine treatment, the spleen being reduced to normal size within seven to ten days after the temperature has come down to normal.

With regard to chronic cases with enlarged spleen (plus 2 or more), no marked effect was noticed with either treatment, 46 cases being kept under observation for one month without marked improvement, but, on being put on spleen mixture, in 22 cases the spleen was completely reduced to normal size, while 24 showed marked improvement. Quinine sulph. gr. v, ferri

sulph. gr. iii, mag. sulph. ʒi, acid sulph. dil. ♏x, aq. ad ℥i, was the spleen mixture used.

Hospital 15 (306 cases treated). In so-called cases of malarial cachexia with greatly enlarged spleens, the spleens were reduced from umbilical level to one finger after seven days plasmoquine and quinine treatment (details not given).

Opinions therefore remain very divided as to the effect of the treatment in the reduction of chronic enlargement of the spleen. It appears to be accepted, however, that in acute enlargement the treatment is effective in reducing the spleen to normal size, at least in the usual time, if not actually quicker than the normal quinine treatment.

Suitability of the Treatment for the Control of Pyrexia.

As very few comments have been made by any hospital on this point it may be accepted that, as a rule, the control of pyrexia was at least as efficacious as with the usual quinine treatment.

In the Southern Command "it was found on the whole that patients responded more rapidly to treatment with plasmoquine and quinine than quinine alone. In no case was it necessary to give intravenous or intra-muscular quinine" (note of medical specialist Southern Command).

One hospital in the Northern Command also noted that the combination of the two drugs reduced the temperatures quicker than quinine alone.

It was found necessary, however, in a few cases with heavy infections to increase the quinine to thirty grains per day until the malarial paroxysms were checked, when the quinine was reduced to the usual twenty grains. This point is brought to notice by two hospitals and by the medical specialist in the Lahore District, but is not mentioned by other hospitals.

Relapses.

As stated earlier in the report, it was considered impossible to exclude fresh infections from relapses in many stations. Therefore the relapse rate among the cases treated in certain hospitals must be considerably greater than the true relapse rate. On the other hand it is possible that a few cases which did relapse after a change of station were not reported as such in spite of the instructions that all such relapses were to be notified to the officer keeping the records of the cases. Such cases would help to counter-balance the number of fresh infections, but from a study of the hospital registers it appears that they cannot have been very many.

The period of observation of the cases discussed in this report varied from three to six months with an average of four and a half to five months. Any cases treated after December 31, 1929, are not included. The percentage of relapses among the cases treated in various military hospitals is given in Table IX. The comparatively high percentage in highly malarious stations, compared with other less malarious stations, should be noted.

The relapses appear, therefore, to have been surprisingly few, the average for all classes and all stations being 5·2 per cent. If cases relapsing after what may be roughly called the end of the malarial season in the various stations only were accepted as relapses, the relapse-rate would be as low as 2·4 per cent.

TABLE IX.

British Military Hospital	Admission ratio per 1,000 Sept., 1930	Cases	Relapse percentage after treatment	Indian Military Hospital	Admission ratio per 1,000 Sept., 1930	Cases	Relapse percentage after treatment
Poona	4·3	97	1·03	Nasirabad ..	85·2	170	4·7
Mhow	23·4	91	3·2	Jubbulpore ..	14·1	125	0·0
Nasirabad ..	96·0	110	10·0	Nowshera ..	7·2	146	8·9
Jubbulpore ..	14·2	180	5·0	Rawalpindi ..	19·7	106	0·0
Nowshera ..	57·4	143	9·0	Lahore ..	39·2	248	5·6
Rawalpindi ..	31·9	27	22·2 (6 cases)	Peshawar ..	31·8	301	10·6
Lahore ..	3·8	147	1·3	Jhelum ..	24·2	92	1·08
Peshawar ..	20·8	147	8·8	Bannu ..	17·7	103	16·5
Sialkot.. ..	15·2	22	0·0	Sialkot ..	17·1	58	3·4
Jhansi	43·3	9	0·0	Dehra Dun ..	15·3	49	0·0
Dalhousie ..	*37·1	27	0·0	Shillong ..	2·1	89	2·2
Lucknow ..	34·6	91	0·0	Lucknow ..	23·4	112	0·89
Allahabad ..	62·6	39	2·5	Delhi	36·2	51	0·0
Cawnpore ..	63·3	20	0·0	Quetta ..	25·6	36	0·0
Delhi	82·8	53	1·8	Karachi ..	9·4	20	0·0
Fyzabad ..	3·1	11	0·0	Maymyo ..	19·0	136	10·2
Quetta ..	34·1	38	2·6				
Karachi ..	18·3	34	5·8				

* 35 per 1,000 were relapse cases.

The figures for the relapse-rate, although they cannot be accepted as accurate, are definitely very favourable as compared with the usual quinine treatment. In the quinine-treated control series of Sinton, Smith and Pottinger (1930) at Kasauli the relapse-rate was as high as forty-two per cent. Using the same treatment as was employed for these cases they reduced the relapse-rate to eight per cent. The relapse-rate in the present series, as applied to the total cases treated, is even lower.

DEATHS.

There were two deaths among the Indian cases.

The first was a sepoy, aged 32, with fifteen years' service. He was admitted with a history of rigors, pains and vomiting for two days, temperature 102° F. Spleen and liver not palpable. *P. vivax* ring forms present. Placed on plasmoquine and quinine treatment.

3rd day. Urine normal, temperature 98° F.

4th day. *P. vivax* gametocytes and *P. falciparum* crescents in blood, quinine not being excreted in urine.

5th day. *P. falciparum* crescents present, quinine demonstrated in urine.

6th day. Rigor and vomiting, temperature 102·4° F. No toxic symptoms of plasmoquine. No plasmoquine after this date.

7th day. 9 a.m. Temperature 100° F. Bile-coloured fluid vomited. Complained of pains in chest and abdomen. No signs of cyanosis present, but difficulty in breathing. Abdomen flaccid, spleen not palpable. Jaundice marked. Pulse 104, rather weak. Heart and lungs nothing abnormal. Urine bile coloured, quinine present in urine.

> *Note.*—Patient did not look very seriously ill, but seemed uncomfortable, and got some ease from abdominal pain in a sitting position.

4.30 p.m. Condition same as in the morning and not considered serious. About fifteen minutes later the patient vomited once and was dead when the Sub-Assistant Surgeon returned.

Post-mortem examination was refused by the relatives and by the unit to which the patient belonged.

The Officer Commanding Indian Military Hospital adds a note :—

"There does not appear to be any connection between the plasmoquine treatment this case was undergoing and the symptoms and signs on the last day of his illness. The bilious vomiting, jaundice and abdominal pain were typical of the bilious remittent type of pernicious malaria. The final syncope was apparently due to cardiac dilatation."

The Medical Specialist, Baluchistan, also states :—

"I am strongly of the opinion that the plasmoquine was not the direct cause of death, but that he already had a hepatic deficiency. Whether the condition was hastened by the administration of plasmoquine it is impossible to say."

The second patient was an Indian groom. His temperature on admission was 100° F., he complained of headache and gave a history of fever for one day. He had a previous history of fever in his village one year ago. Benign tertian rings were present. He was placed on combined plasmoquine and quinine treatment.

2nd and 3rd day. Temperature normal.

4th day. Temperature 101·4° F. No abdominal pain or discomfort. Urine specific gravity 1024. No albumin or sugar present.

5th day. Temperature which had risen to 102·8° F. on the evening of the previous day came down to 99° F. No abdominal pain, but patient looked seriously ill and was passing dark-coloured urine ; temperature 102° F. Plasmoquine stopped.

Evening : patient very restless, breathing shallow and rapid, looked very pale and run down, cyanosis present. Still passing dark, reddish-coloured urine resembling port wine. Specific gravity 1028, blood, bile, and urates present.

6th day. Cyanosed, jaundice marked, restless, bilious vomiting present, methæmoglobinuria.

7th day. Temperature 100·4° F. Pulse weak and irregular. Patient unconscious. Respirations 28 per minute. Marked anæmia, very restless, still passing port wine-coloured urine.

8th day. Patient restless, unconscious, bilious vomiting. Respirations 24 per minute, pulse 100 per minute, cyanosis present, methæmoglobinuria.

9th day. Patient restless and unconscious. Urine scanty, and passed in bed. Methæmoglobinuria and marked cyanosis present.

10th day. Patient died from respiratory failure at 4·00 hours.

Post-mortem report.—

Liver, marked degree of fatty degeneration.

Kidney, marked fatty degeneration. Microscopical examination showed fragmentation and degeneration of lining epithelium of the tubules. Lumen of tubules filled with amorphous debris, partly derived from the lining epithelium, but chiefly composed of hæmoglobin or a derivative therefrom. Melanin pigment present in considerable amount.

Spleen.—Melanin pigment present and pulp sinuses filled with debris of hæmoglobin or its derivatives.

History of two cases of methæmoglobinuria which recovered.

Case 1.—Indian recruit.

1st day. Pyrexia and rigor. Blood-smear negative.

2nd day. Temperature normal.

3rd day. Pyrexia and rigor. *P. vivax* ring forms present.

5th day. Temperature 101·6° F. Plasmoquine (0·04 gramme) and quinine (grains xx) treatment commenced.

6th-8th day. Normal.

9th day. Abdominal pain and vomiting, yellow tinged conjunctivæ. Plasmoquine stopped.

12 noon. Condition as above.

6 p.m. Temperature 104° F. Rigor, vomited bile-stained matter, pain in loins, lower abdomen and liver region. Jaundice marked on skin and conjunctivæ, pulse rapid, blood-smear negative for malaria parasites.

Urine dark colour, albumin present. On standing separated in two layers, top of brownish colour and lower of brownish sediment. Tube casts and red blood corpuscles in sediment.

8 p.m. Epigastric pain intense, eyes sunken, face pinched, pulse rapid and thready. Frequent desire to pass urine, and passes one to two ounces of dark-coloured urine.

10th day. Condition as before. Temperature 100° F. Urine dark coloured, patient cannot retain anything.

6 p.m. Temperature 103° F. Condition as before.

11th day. Temperature 99° F. Urine dark-coloured, albumin present.

12th day. Temperature normal, urine still dark-coloured, albumin and tube casts present.

13th day. Temperature normal, urine faint dark colour, albumin and tube casts present, jaundice much less, pain in loins less.

14th day. Temperature normal, urine much clearer, no tube casts, slight traces albumin.

15th day. Condition much improved.

The condition of this patient steadily improved, and on the 20th day he is noted as having recovered.

Case 2.—Indian groom (methæmoglobinuria).

1st day. On admission pyrexia 101·6° F. Spleen just palpable. Blood, benign tertian rings. Two days' fever prior to admission to hospital. History of fever in his village three months ago. Commenced treatment.

2nd day. Temperature 100° F.

3rd day. Temperature 99·6° F.

4th day. Temperature 99·4° F. Jaundice present. Plasmoquine stopped.

5th day. Temperature 99·6° F. Urine specific gravity 1022. Blood? and bile present.

6th day. Temperature normal. Urine less deep in colour than yesterday.

7th day. Temperature 99° F. Improved and urine less deep in colour.

10th day. Doing well. No blood or bile in urine.

Patient made an uninterrupted recovery.

The first death occurred in a case of definite mixed infection, as gametocytes of *P. falciparum* were present in the blood. As a post-mortem was refused, the cause of death must remain uncertain. Neither the officer commanding the hospital concerned nor the medical specialist of the district was of opinion that death could be attributed to the plasmoquine. The total amount of plasmoquine given to the patient was 0·18 gramme, during treatment for four and a half days.

The case in which the second death occurred appears to have presented all the symptoms of a typical attack of blackwater fever. It is possible that the ring forms of malarial parasites, although described as *P. vivax*, may have been actually *P. falciparum* rings. As, contrary to instructions, the blood-films of these cases were not retained in the hospital, the original diagnosis could not be confirmed. The patient was an Indian groom, a class of individual often heavily infected with subtertian malaria from childhood, and there was a definite history of an attack of malaria while on leave in his village. The total amount of plasmoquine administered was 0·16 gramme during four days' treatment.

Methæmoglobinuria.—The first case was similar in all respects also to a case of blackwater fever, and may have been a case of mixed infection. The patient was a recruit, and in few Indian villages is it possible to escape a subtertian infection. The case also occurred in Jubbulpore, a highly malarious station, and about the same time fifty-five cases of a subtertian malaria and several cases of mixed tertian and subtertian infections were treated in the same hospital.

The second case appears to have been very much milder in type. The notes on this case are not sufficiently full to be of much value, but as the

temperature did not become normal for eight days from the onset of pyrexia, and the patient was an Indian groom, subtertian infection was probably present.

Excluding the first death as not due to plasmoquine, there have been therefore three cases of methæmoglobinuria, with one death among the Indian group. All these cases were in all probability either mixed infections, or pure subtertian infections, and as quinine was administered as well as plasmoquine, it is impossible to say which drug precipitated the attack of blackwater fever.

If the methæmoglobinuria and blackwater fever symptoms in general are to be attributed to the direct toxic action of plasmoquine, apart from an ordinary attack of blackwater fever, it is difficult to believe that a case would not have occurred among the British group treated (1,298 cases). It is probable that the treatment produced in the affected patients conditions which enabled an attack of blackwater fever to occur. That such conditions may be equally produced by quinine and other factors such as chill, alcohol, etc., is well known.

In all cases the symptoms appeared in the early stages of treatment, on the fourth and fifth day. As well over 1,000 cases of subtertian malaria received plasmoquine treatment in a similar daily dosage for five days in addition to the 3,213 cases receiving twenty-one days' treatment, many cases of mixed infections being undoubtedly included in the Indian group, the percentage of cases in which an attack of blackwater fever was precipitated by the plasmoquine and quinine treatment must have been very small, probably no greater than with the usual quinine treatment.

Manson Bahr (1927) (*a*) describes a case of methæmoglobinuria in a case of *mixed* infection treated with plasmoquine, the daily dose of plasmoquine being 0·12 gramme; symptoms appeared after a total amount of 0·4 gramme, a much larger quantity than was given in the present series.

Various authors, Muhlens and Fischer (1927), Schulemann and Memmi (1927), Polychroniades (1927), Talianidis (1928), report on cases of blackwater fever treated successfully with plasmoquine: which appears to indicate that the methæmoglobinuria in the three cases in this series could not have been due to the direct toxic action of the small doses of plasmoquine employed. Eiselsberg (1927) however reports one case with no history of malaria, in which, after 0·2 gramme plasmoquine, symptoms similar to those of blackwater fever developed.

The question whether the symptoms in these cases can be attributed directly to plasmoquine must be considered therefore as undecided. On the whole it is thought that probably they were not so attributable.

The opinions of the medical officers who supervised the treatment in a large number of cases are given below. In certain hospitals comparatively few cases were treated, and although the impression gained was favourable medical officers naturally reserved their judgment.

Major E. B. March, M.C., R.A.M.C., Medical Specialist, Baluchistan

Plasmoquine District: "Plasmoquine is undoubtedly a dangerous drug, and unless the results of treatment are very considerably better than any other form of treatment, it is not considered a suitable drug for use in the Army, but may possibly prove useful for selected cases. The treatment was, however, considered effective."

In the British Military Hospital in Quetta forty-three cases completed treatment. No toxic symptoms of any kind are noted as occurring among the last twenty-five cases in the register. Among the first eighteen patients, toxic symptoms are recorded in six cases.

(1) 4th case. Cyanosis marked, finger-nails also affected (tenth day). Did not clear up until four days, so treatment stopped.

(2) 8th case. Abdominal pain and slight cyanosis (seventh day), stopped treatment three days. Symptoms reappeared on first dose, treatment discontinued.

(3) 10th case. Slight giddiness (second day). Treatment stopped one day only, probably functional.

(4) 13th case. Abdominal pain and vomiting (eighth day). Toxic symptoms lasted three days, treatment withheld for four days. Completed course.

(5) 16th case. Cyanosis (ninth day). Plasmoquine stopped three days, cyanosis reappeared on sixteenth day, treatment discontinued.

(6) 18th case. Slight abdominal pains (eighth day), lasted one day, treatment was not withheld.

In the Indian Military Hospital, Quetta, forty-two cases were treated. Toxic symptoms are recorded in three cases, and there was one death.

(1) 2nd case. Epigastric pain seventh day, *while attending medical inspection room* for treatment. Treatment withheld, symptoms lasted seven days.

(2) 4th case. Pain in lower region and diarrhœa (seventeenth day). Symptoms persisted; treatment withheld eleven days.

(3) 9th case. Pain and diarrhœa (fourteenth day), symptoms persisted; treatment withheld for five days.

(4) 37th case. Died on the seventh day. Case already described.

No further toxic cases are noticed as occurring, except one case in which "splenitis" is recorded. Malaria parasites were not found, treatment was stopped for one day. The "splenitis" apparently was not considered to be due to the plasmoquine.

Captain T. J. Davidson, I.M.S., Indian Military Hospital, Sialkot (sixty-four cases): "As a routine measure I certainly do not recommend the use of plasmoquine, and so far I have not found any advantage it has over quinine, but many disadvantages, except in removing crescents from the peripheral blood in M.T. malaria."

In this hospital abdominal pain is recorded in 15 cases, cyanosis in 2, diarrhœa in 5, headache in 2. There were 5 cases of albuminuria, 1 case

of methæmoglobinuria which recovered, and 1 case of methæmoglobinuria which died.

Considering the general absence of toxic symptoms among the large number of Indian patients treated in the other Indian military hospitals, the experience of this hospital must have been singularly unfortunate. The conclusion from the British military hospital in the same station (twenty-two cases) is: "The treatment appears to be extremely efficacious and provided that the need for careful observation of patients by those carrying out the treatment is fully recognized, the general issue of plasmoquine would appear to be highly desirable."

Colonel L. T. Brassey, I.M.S., Assistant Director of Medical Services, Peshawar District: "Opinion in this district is unanimous on the value of plasmoquine treatment of benign tertian malaria as opposed to quinine alone. Its efficacy combined with simplicity of administration and shortness of course has appealed to both medical officers and troops. Toxic symptoms have been so mild that they might have passed unnoticed had not special warning been issued."

Colonel L. T. Brassey, I.M.S., Indian Military Hospital, Peshawar: "Plasmoquine was administered to 395 benign tertian cases of malaria. No serious sequela was complained of by any of the patients. One or two said they had pain in the stomach, but this soon passed off. No case of cyanosis has occurred. The opinion formed here is that plasmoquine had a very decided effect on the malaria parasite, and that it is a useful addition to the list of drugs for this condition. It is specially useful as an adjunct to quinine in the chronic relapsing case."

Lieutenant-Colonel A. F. Baboneau, C.I.E., I.M.S., Indian Military Hospital, Nowshera (144 cases): "During the experiment mild toxic symptoms were noticed in certain cases. Issue of plasmoquine as a general issue is recommended."

Major H. H. Blake, C.B.E., R.A.M.C., British Military Hospital, Nowshera: "Plasmoquine is recommended as a general issue. In this hospital 153 cases B.T. malaria were treated this year. Six have relapsed so far."

Major J. F. Bourke, M.C., R.A.M.C., British Military Hospital, Peshawar: "Total number of B.T. cases treated was 146. Eight complained of epigastric pain, and 5 displayed signs of definite so-called cyanosis. In the light of the experience gained while conducting these observations, I can now say that in no case were the signs and symptoms such as would have caused uneasiness in the mind of an experienced clinician habituated to this form of treatment. When the treatment started the evident apprehension of untoward results had a psychological effect among the patients and caused them to exaggerate minor discomfort. The treatment has definitely given a lesser incidence of relapses. It saves the soldier from a long and wearisome course of post-hospital quininization. This has made it popular with the troops in this station and has simplified

the administrative arrangements for men proceeding to England, or on school courses, leave, etc., in this country."

Major J. Bennet, R.A.M.C., British Military Hospital, Lucknow (91 cases): "In estimating the frequency of colic as a complication in the treatment of these cases, unfortunately the effect of suggestion cannot be eliminated where the symptoms have occurred once, or in cases where the patient has heard of others being affected in this way by the drug. No cases of severe dyspnœa or methæmoglobinæmia occurred in the series of cases in whom the treatment was tested. The value of plasmoquine in combination with quinine in the treatment of benign tertian malaria is probably very great; and the ill-effects of its administration are slight and easily recovered from. Many cases with previous history of numerous relapses volunteer statements that they feel more physically fit under this treatment than they did when treated by previous methods."

Major V. J. Bonavia, R.A.M.C., Medical Specialist, Lahore District: "The results obtained were very satisfactory and encouraging. The treatment was simple and easy to carry out, and the toxic symptoms encountered were practically negligible, all cases having been able to complete their course. The patients were all warned what early toxic symptoms might occur, and daily asked if they felt any of these symptoms. As soon as these occurred the treatment was interrupted, to be again resumed as soon as the symptoms cleared up, usually in one or two days' time. By this simple precaution no cases causing anxiety were encountered. The second rule was not to give the plasmoquine on an empty stomach."

One hundred and fifty-two cases of benign tertian malaria were treated in the British Military Hospital, Lahore. Only two cases are known to have relapsed. One relapsed twenty-three days after completing the course, and one on the day following his course. They were both put through a second course and have not relapsed since. Of the 152 cases, only 8 showed toxic symptoms which occurred from the seventh to the eighth day, and treatment was interrupted for one or two days.

Six cases complained of epigastric pain. Treatment interrupted from one to two days.

One case had epigastric pain and vomiting. Treatment interrupted, two days.

One case had epigastric pain and cyanosis. Treatment interrupted one day.

Major H. G. Winter, M.C., R.A.M.C., British Military Hospital, Lahore (152 cases): "Toxic symptoms which occurred in a very few cases were of extremely mild nature. From my experience of malaria and its treatment gained in Egypt, Palestine, Cyprus, as well as in this country, I consider that the drug is a decided advance in treatment, and I recommend its general issue."

Lieutenant-Colonel S. Whitworth Jones, C.B.E., I.M.S., Indian Military Hospital, Lahore (253 cases): "It seems to me that plasmoquine has been

efficacious in reducing the number of relapses and can be recommended as a general issue."

Major S. R. Prall, I.M.S., Indian Military Hospital, Shillong (89 cases): "There were no cases exhibiting toxic symptoms. In a few individuals the pulse-rate became somewhat slow. It is considered that the treatment was highly successful, not only in the prevention of relapses, but also in diminishing enlarged spleens."

Major H. B. F. Dixon, R.A.M.C., Medical Specialist, Southern Command (108 cases): "At the beginning of the period there was a certain amount of nervousness on the part of the staff and patients on account of the warning regarding abdominal pain, and I feel sure it was suggested to the patients. However, as time went on, more confidence in the treatment was obtained and the alleged abdominal pain was not noticed. A certain amount of cyanosis was noticed in the early stages, also possibly on account of the warnings, and several patients had treatment discontinued for a few days, but as time went on the number of cases in which cyanosis was sufficient to discontinue treatment fell to almost nil.

"In my opinion cyanosis is the first evidence of toxic symptoms, and unless it is marked it is quite harmless. Discontinuance of the treatment for a few days immediately brings the patient back to normal.

"*Conclusions.* (1) Treatment of B.T. with plasmoquine and quinine is quite satisfactory.

"(2) The administration should be done for first seven days in hospital and then after under medical supervision, patient being excused duty for twenty-one days in all.

[General experience appears to indicate that ten days' hospital treatment is preferable to the seven-day period suggested above.]

"(3) The control of the pyrexia is more easily done than by quinine alone and the period in hospital is on the whole as short.

"(4) Toxic symptoms in order of appearance are cyanosis, abdominal pain, icterus, methæmoglobinæmia.

"(5) Stopping of the drug for a few days prevents any toxic symptoms developing, soda bicarb. and glucose are recommended for cyanosis.

"(6) In the series of cases reported on the toxic symptoms were remarkably few, and in my opinion were largely the result of suggestion.

"(7) The relapse rate is strikingly low, 1·85 per cent as compared with 18·1 per cent in quinine alone taken over a period of nine months.

"(8) I strongly recommend that plasmoquine with quinine treatment be instituted as a standard treatment."

Captain S. C. H. Worseldine, I.M.S., Indian Military Hospital, Jhelum: "121 cases were placed on treatment and six showed toxic symptoms of a mild nature, so slight as not to interfere with the general use of the drug. Relapse occurred in one case only. From the small number treated the treatment would appear to be satisfactory."

Captain A. Sachs, R.A.M.C., British and Indian Military Hospital,

Jubbulpore (406 cases): "Owing to the short time of treatment it is impossible to arrive at definite conclusions. The relapse rate has certainly fallen enormously. It seems with due care that plasmoquine is a valuable adjuvant in the treatment of malaria."

Major E. Underhill, R.A.M.C., Specialist in Medicine, Mhow District: "Two points appear worthy of note: (1) The mildness of toxic symptoms; (2) the small number of relapses after treatment.

"(1) As regards toxic symptoms the majority of cases treated showed none. In one case only were toxic symptoms severe, and in one case marked; cyanosis being noted in both of these. In the remainder abdominal *discomfort* or slight cyanosis only was observed. In no cases did the occurrence of toxic symptoms prevent the eventual completion of treatment.

"(2) Two cases only were admitted to hospital for a second attack of malaria after completion of treatment. In both cases the second admission was for M.T. malaria, the first being B.T.

"In view of the foregoing and with due allowance for the smallness of this experience with the drug, I am definitely of opinion that this line of treatment is a distinct advance in the treatment and control of malaria. I consider, however, that the treatment should continue to be accompanied by careful supervision of the patients, and that before it is universally adopted the disadvantages should be clearly understood by all medical officers undertaking the treatment."

In conclusion the objects of the investigation may be reconsidered, with a view to ascertaining whether answers to the questions at issue have been arrived at.

(1) *Whether the treatment may safely be given to all classes of patients whatever their physique may be?*

The answer as far as the British soldier in India is concerned appears to be definitely "yes." As regards the Indian sepoy and follower the answer appears to be also in the affirmative for the great majority of cases.

In a small minority, about 0·1 per cent, it is possible that an attack of blackwater fever may be precipitated in individuals who have suffered from many attacks of subtertian malaria. The percentage is probably even smaller than appears from the results in this series of cases, as plasmoquine in larger daily doses, and over a period of five to twelve days, has been used to destroy the gametocytes of *P. falciparum* in most tropical countries. The number of cases treated must by now be very large, and instances of methæmoglobinuria occurring after treatment seem practically negligible from the literature available.

As in both British and Indian cases there appears to be a small percentage with a definite idiosyncrasy to the toxic action of plasmoquine, patients will require to be kept under observation, and should be excused duty during the three weeks' treatment. While keeping the symptoms of

the toxic effects in mind great care is obviously necessary to avoid the effect of suggestion on the minds of patients with regard to these symptoms.

It also appears that minor manifestations may, as long as a watchful attitude is adopted on the part of the physician, be disregarded in the large majority of cases and treatment not withheld.

(2) *Whether such toxic effects were observed more frequently in the British or Indian group?*

The answer appears to be that epigastric pain, cyanosis, etc., were less frequent among Indian cases, but that the difference in the incidence was probably largely due to colour, and to the different mentality in the two groups. If the later cases in the registers of both groups are compared, there is little difference in the incidence of toxic symptoms.

(3) *The incidence and importance of toxic manifestations.* These are fully discussed in the body of this report. The incidence is low, and would certainly be lower in any future series of cases treated by the same medical officers. Toxic symptoms are of importance only in a very few cases with special idiosyncrasy, and as long as a look-out is kept for the possible occurrence of such cases, after a temporary cessation for a day or two the treatment may safely be continued in the great majority of cases.

(4) *Was the treatment efficacious in preventing relapses?* There is no doubt that it is *most* efficacious and a great advance on the ordinary quinine treatment. By its introduction, post-hospital courses of quinine can be abolished and the relapse rate reduced to a very low figure, thus benefiting not only the health of a large number of patients, but at the same time causing a saving to the State by diminishing the number of readmissions to hospitals annually.

(5) *Can plasmoquine be safely issued to patients not under medical supervision?* Although not of great importance as regards the Army in India, in which treatment can always be controlled, the question of whether the drug can be safely issued to patients not under medical supervision is constantly being referred to in the literature. From the results obtained in the present series of cases with a continuous daily dose of 0·04 gramme plasmoquine for twenty-one days, the answer would appear to be definitely in the negative. Good results might be met with in ninety-nine cases, but disaster might occur in the hundredth case.

If the margin of safety can be made greater, and good results obtained by utilizing 0·03 gramme plasmoquine as the daily dose plus quinine 20 grains for twenty-one days, a definite advance would be made.

Investigations on these lines are being carried out at the Malaria Treatment Centre, Kasauli. Major A. E. Richmond, O.B.E., R.A.M.C., reports that up to date 57 cases have been treated. Toxic symptoms have been non-existent, and the patients have been able to pursue their normal avocations in the depot, including an occasional game of hockey or football. Four cases (7 per cent), however, have relapsed after treatment, and 20 of the 57 cases have not yet completed eight weeks' observation.

Thanks must be given to the medical officers of the R.A.M.C. and I.M.S. who undertook this investigation in the various hospitals. It is considered that the results obtained are of great interest and that they afford valuable information for medical officers undertaking the treatment in future.

Acknowledgments are also due to the Havero Trading Company, Ltd., the agents in India for the manufacturers of plasmoquine, who supplied a large quantity of the drug free of charge, and to Dr. O. Urchs, M.D., for translations and reprints of some of the most important articles on the subject, and also for a very complete bibliography of the literature up to July, 1930.

BIBLIOGRAPHY.

BAERMANN, G., and SMITS, E. (1927). *Geneesk. Tijdsch. v. Ned. Indie*, lxvii, 1, p. 151.

BROSIUS, P. (1926). Fifteenth Annual Report, United Fruit Co., p. 72.

EISELSBERG, KARL P. (1927). *Wien. klin. Woch.*, xl, No. 16, p. 525.

FISCHER and WEISE, W. (1924). "Ueber Wirkungen and Nebenwirkungen des Plasmochins bei Behandlung der menschlichen Malaria," *Deutsche med. Woch.*, No. 33, p. 1380, and No. 34, p. 1421.

FISCHER, O., and REINDORF, G. (1928). "On the Question of the Secondary Effects of Plasmoquine," *Arch. f. Schiffs- und Tropen-hyg.*, 1928, xxxii, 544-597.

FLETCHER and KANAGARAYER, K. (1927). "Plasmoquine in the Treatment of Malaria," *Indian Medical Gazette*, No. 9, p. 499, and *Bull. Inst. Med. Res.*, Federated Malay States, No. 5.

GREEN, R. (1929). *Bull. Inst. Med. Res.*, Federated Malay States, No. 3, p. 8.

MANSON BAHR, P. (1927). *Trans. Roy. Soc. Trop. Med. and Hyg.*, xx, 7, p. 413.

Idem. (1927) (*a*). "The Action of Plasmoquine on Malaria," *Proc. Roy. Soc. Med.*, xx, No. 6, p. 919.

MENK, W, (1928). Sixteenth Annual Report, United Fruit Co. (Medl. Dept.), pp. 78-79.

MUHLENS, P. (1926). "Die Behandlung der natürlichen menschl. Malaria Infektion mit Plasmochin," *Beih. z. Arch. f. Schiffs- und Tropen-Hyg.*, xxx, No. 3.

Idem. (1927). "Die Plasmochin Behandlung der Malaria," *Deutsch. med. Woch.*, 1927, Nos. 45-46, p. 1891.

MUHLENS, P., and FISCHER, O. (1927). "Die Behandlung der natürlichen menschlichen malaria mit Plasmochin.," *Beih. z. Arch. f. Schiffs- und Tropen-Hyg.*, 1927, xxxi, H. 1, p. 7.

POLYCHRONIADES (1927). *Ibid.*, xxxi, M. 1, p. 117.

ROEHL, W. (1926). "Die wirkung des Plasmochin auf die Vogel Malaria," *ibid.*, xxx, No. 3.

SCHULEMANN and MEMMI (1927). *Ibid.*, xxxi, H. 1, p. 59.

SINTON, J., and LAL, R. (1924). *Indian Journ. Med. Res.*, xii, 1, p. 47.

SINTON, J. A., and BIRD, W. (1928). "Studies in Malaria, with Special Reference to Treatment. Plasmoquine in the Treatment of Malaria," *ibid.*, July, 1928, xvi, No. 1, p. 159.

SINTON, J. A., SMITH, S., and POTTINGER, D. (1930). "Further Researches into the Treatment of Chronic Benign Tertian Malaria with Plasmoquine and Quinine," *ibid.*, xvii, No. 3, p. 793.

SIOLI, F. (1926). "Prüfung des Plasmochins bei der Impf-malaria der Paralytiker," *Beih. z. Arch. f. Schiffs- und Tropen-Hyg.*, xxx, No. 3.

TALIANIDIS (1928). *Ibid.*, xxxii, M. 12, p. 607.

WALLACE, R. (1928). *Malayan Med. Journ.*, iii, No. 4, p. 145.

OUR STATION.

By OLA.

(*Continued from p.* 358.)

Thus far we have progressed by hopping from ledge to ledge; but now —would you care to come with me round the cantonment?

No; that is wrong. In Our Station the invitation runs: Would you care to accompany me *through* the cantonment? Yes? Then let us start from the dairy, at the top of the ridge.

The dairy is admirably housed in officers' quarters, which have been reappropriated. Doubtless in some record office or other there exists a letter addressed to the G.O.C.-in-C., beginning thus:—

> "Sir—I have the honour respectfully to point out that I and the officers under my command are bipeds—not chamois, etc."

This letter will be signed, "John Mellow, Major, 123rd Foot, Cmdg. West End, Our Station."

No doubt, too, somewhere or other there is filed an answer of this sort:—

> "Sir—The G.O.C.-in-C., while deprecating the levity which is a feature of your communication, agrees with you that, etc."

Presumably the C.M.A. concurred; or—a more likely surmise—in those days there was no C.M.A.

The dairy cattle consist of the progeny of Indian cows which have been mated with a South African bull, and they are not unlike brindled Friesians. The Indian type of head is apt to persist, but the hump disappears.

In these mountain fastnesses the upkeep of a high-class herd is costly and difficult; and although the output per head is high, the total yield only suffices to meet our requirements in milk and cream; butter has to be imported. It is imported from dairy headquarters in the plains, sixty miles away by road. It is well salted, coloured a bright saffron and sent up to us in kerosine tins. Despite these attractions, its semi-oily appearance and consistency on arrival have made it unpopular; it is too like ghi—ugh!

In Our Station we do not boast about the butter.

As we approach the dairy premises we observe amongst the personnel and animals a sudden, purposeful stir—a quiet, disciplined activity—a movement whose precision indicates practice; the Marthas of the herd—the water-buffaloes—are being driven to the place of concealment; or, at least, to a place where their presence will not attract undue notice. This manœuvre, to be well done, requires considerable energy and skill, for water-buffaloes are slow movers and by no means easy to hide. They loom large on the landscape. "But why hide them?" you ask. Because

buffalo's cream, and cow's milk which has been fattened with buffalo's milk, are unpalatable to most of us. A good dairy manager knows that, when visitors are about, the farther the buffaloes are kept in the background, the better for all concerned.

The manager here is a favourite of ours. He runs a good show, and he is always ready to listen to advice, and eager to carry out suggestions if he possibly can. He is a Jat from the Punjab, clean, hard-working and knowledgable. He deplores the soft, salted, saffronized butter. "Sir, it is not my bandobast; it is decreed by higher authority." He assures you that, although everybody's milk supply may not be wholly from the cow, yours, at least, is The Real Mackay. He gives you the impression that the best cow in the herd is reserved solely for your special benefit, and he does it so well that you begin to wonder if it is, in fact, the case. "Sir, you do not like buffalo's milk; but we poor people enjoy it. Therefore, none of the output is wasted, and everyone is pleased, thank God."

You notice a comely figure hovering in the background. "Ah, your wife, manager-ji. She must find it very lonely up here."

"She does. You see how interested she is in your honour's presence. We have few visitors."

"Still, she is not alone; there is the family."

"Woe be unto me! I have no family."

"Then what about these?" you ask, pointing to a couple of olive-skinned cherubim who are clinging to the tail of his shirt.

"Oh, these! ahem—these are only daughters. Hence, I have been compelled to arrange for a second wife. I am getting married next week. God willing, I may have a family this time—many sons, I hope."

He may want the sons; but, on the other hand, he may not. However, he has no choice in the matter; religion compels; and should he die leaving no son behind, his chances in the next world are too horrible to contemplate.

One of the most astonishing phenomena in India is that of the "Not at Home" box. The advent of this little box must have given a tremendous fillip to the visiting-card industry. In the passage of time its vogue has in no way declined; and when we all evacuate this great peninsula, it is unlikely that the card trade will survive the blow—unless our Aryan brethren continue to support and develop the business as they are now doing. It makes you marvel at the workings of the imitative faculty. You wonder how on earth the Indian could possibly have chosen to adopt, whole-heartedly, the most idiotic of all the idiotic customs of the West.

Be that as it may, our friend at the dairy—the scion of a thrifty, sturdy peasantry—has caught the infection. He is distinguished by the large number of out-size visiting-cards which he has had printed in a somewhat florid style, and which he distributes with an impartial and lavish hand.

These cards are of a pale sea-green colour, *teinte mal de mer*, and are edged and lettered in gold.

Mr. Bhuj-Bal Singh,
Manager.
The Government Dairy,
Our Station.

In the matter of visiting-cards Mr. B.-B. Singh does not stand alone. He has a serious rival in the cantonment executive officer. We shall meet the C.E.O. later on; but here it may be said that this gentleman also seems to have nautical leanings, for his cards are of a delicate shell-pink shade, edged and lettered in silver.

These two worthies have partisans (what Indian officials have not?) and a never-failing topic for debate is: "Who is the more generous in the matter of visiting-cards; the dairy manager or the C.E.O.?" This question has served to enliven many a dinner table in Our Station. Between the two distributors, the station staff officer and I managed to collect about 300 cards; and by means of them we made an improvised, but quite efficient, card-index file which we presented to the O.C., Station, on his birthday. Needless to say the O.C. was delighted, and added his little lot —another 200 cards. Others came forward with their contributions, but we could not find a box properly dimensioned and long enough to hold the thousand or so pieces of pasteboard.

On descending the hill we skirt the West End officers' mess. This mess is noted for the fact that it seldom sees a guest because, on the way down, you do not need any refreshment; and on the way up, although you would give your soul for a drink you are too exhausted to climb beyond the post-office. The mess is 250 feet above that. At an altitude of 8,300 feet it is probably one of the highest as it is certainly one of the cheapest and most exclusive messes in Asia.

Below the mess is a bungalow bearing the legend "Single Captain, R.A.M.C." It is empty. Below this again is the detention hospital.

The hospital is in sub-charge of Assistant-Surgeon Emanoel José Pedro Pereira, I.M.D., a slim little man with a pedigree much longer than himself. I have seen this pedigree; it was extracted from a cylindrical tin case with a flourish such as Dom Miguel Marie Pereira might have executed in drawing his fine Toledo blade. It stretches to Goa, centuries back.

Mr. Pereira has a delicate grey moustache, heavy grey eyebrows and a bald head. A pair of brown eyes are set in a walnut-coloured face. He

moves about like a cat, quiet, lissom, unobtrusive. His voice is soft and monotonous, and his manner languidly graceful. He is never sure whether he should do it himself, or wait until you arrive. It is easy to wait. Then, if you do it, good and well; and if you decide that he shall do it—equally good and well. He is due shortly to retire on pension; but whether to settle down with his maternal relatives in Bangalore, or with the paternal side of the family in Bombay, or with his connections by marriage in Dehra Dun, he cannot decide. The only thing he is sure about is, that it is unsafe to be sure about anything. The little man has many good qualities; his bad ones are mainly negative—except that unfortunate habit of being for ever head over ears in debt. Mr. Pereira has expensive tastes.

Assistant-Surgeon Georges Épinard Le Quesnoy, in sub-charge of the military hospital, East End, is quite a different type. He is a Breton, ex-Pondicherry, where his great-great-grandfather—bo'sun on the frigate "Jouteur"—left the sea for good without asking his skipper's permission. Mr. Le Quesnoy is another short man; but he is thick-set, powerfully built and walks with a roll. He has blue eyes, a ruddy complexion and a mop of red hair which no amount of brush cum soapy water will keep in order. Although well over 40 years, he is still a useful hockey back and an excellent tennis player. Some people call him thrifty and others, such as Mr. Pereira, say he is mean; but then, he consistently refuses to make that small temporary loan for which Mr. P. so often applies. Mr. Pereira plays the rabbit with a costly English racquet; Mr. Le Quesnoy volleys and drives with a country-made affair. At the end of the set—six, love—Mr. Le Qnesnoy says: "No wonder you can't play, José. If I had that racquet of yours, I'd feel it was burning the skin off my hand."

When you ask Mr. Pereira to quote an authority, he says glibly and confidently: "Para. 13, R.A.I., M.S.," and down it goes. Later on you discover to your cost that the relevant paragraph is No. 12, or 14, or any number except No. 13. This is quite unlike Mr. Le Quesnoy: he never makes a mistake of this kind; indeed, his knowledge of, and respect for, regulations is often somewhat trying. In this matter he is a typical French bureaucrat. If you attempt to do anything which is not strictly according to "the book," you will find in him a bitter, determined and obstinate obstructionist. Should your persistence prevail, it is ten chances to one that, in the end, he will be able triumphantly to declare: "Sir—I told you so." The trouble is, that the methods of Gallic bureaucracy are more suited to the Indian mentality than is the looser and more individualistic outlook of the British; and nowadays Government service is so packed with the babu-log that the rigid line of action is safer and more peaceful than the paths of originality.

It is doubtful if Messrs. Pereira, Le Quesnoy and O'Flaherty are appreciated as much as they deserve to be. Do we realize how much we owe to

them ? Do we give them credit for their steadfast loyalty ? Do we remember their handicaps ?

I think not.

We are too prone to forget that ancestral accidents, climatic perils and racial hatred and contempt are formidable obstacles in the struggle for existence. It is not surprising that the domiciled community has its failures ; but it is surprising to find that, generally speaking, its members attain and maintain a standard of efficiency of which they may well be proud.

Reflecting thus, we approach the detention hospital. For the moment it is impossible to enter, as there are six men, out-patients, on the verandah, and each man is accompanied by two dogs. One of the latter is chained to the staple of a board whereon you may read: "No dogs allowed in the hospital." Mr. Pereira's three canine friends have joined the gathering, and half a dozen wanderers have looked in to see what all the fun is about. Total, over twenty. Barking, yapping, snarling, fighting—the pack converts the house of healing into a bedlam of confusion and noise.

You are a dog lover ? So am I. But—like everything else—the cult can be carried to excess, as it is all over India. It would be easier to deprive the British soldier of his beef ration than of his dog ; and his—and his officer's—tenacity is only strengthened by measures directed towards limitation, such as registration, taxation, labelling, shooting, and so forth.

In Our Station the preservation and propagation of dogs are carried beyond the uttermost limits—sanitary limits included. The personnel of the detachments here represent about one-third of their respective units in the plains ; but the dogs in cold storage are up to full strength, thus :—

	Os. and O.Rs.			Dogs		
Plain Stations : *Our Station* : :	$\frac{2}{3}$	:	$\frac{1}{3}$	: : *Nil*	:	$\frac{3}{3}$
i.e., : :	1,600	:	800	: : *Nil*	:	2,400

Of course it would be both cruel and dangerous to keep the dogs down in the plains in the hot weather ; but 2,400 dogs—not including a pack of foxhounds and innumerable pariahs—is a heavy load to carry on a knife edge. I do not say that 2,400 may not be a slight exaggeration ; but I do say that there cannot possibly be any exaggeration about the types and varieties of breeds. Further than that, it is advisable to say nothing at all. In Our Station canine eugenics is a neglected subject.

Of course the cure is to bring about a drastic reduction in the canine population. As this is utterly impossible, there is no cure.

Vive l'hydrophobie !

To the above remarks there is a single and important exception, viz., "Punch," "Tim," "Lassie," "Bridget"—or whatever YOU call the four-legged and faithful sharer of your joys and sorrows.

Meanwhile there is nothing for it but to return to the detention hospital on a more propitious and less doggy occasion.

"Hi ! doctor, I want to speak to you."

There are two or three very unpleasant women on the married strength of the 22nd Cuirassiers—as there are on the strength of any regiment or battalion. Here is one of them: Mrs. Saugor, wife of the rough-riding corporal. She signals frantically with a red paper parasol, and ascends the path with the agility and assurance of a jennet. There is no escape, for the dogs hem you in on three sides, and on the fourth, Mrs. Saugor with her Alsatian-Airedale blocks the way. As she comes trotting along you see a somewhat misshapen topi surmounting a long, lean face. The big eyes are set widely apart and the mouth is small and thin-lipped. Viewed from in front, an equine face, in fact. The rest of Mrs. Saugor is clad in a cotton frock, cream background with a pattern of cherries as big as oranges; cream coloured silk stockings and canvas rubber-soled shoes which once were white.

"Hi! hold on a minnit."

You hold on, as you have held on often before, since Mrs. Saugor is as regular in her attendance at the medical inspection room as she is regular in her unpunctuality; never less than thirty minutes late. Besides it is safer to stand still—very still—because by now the Alsatian-Airedale has occupied a sound tactical position. You are painfully aware that the initiative has passed to the other side.

"Good morning. Late again, eh?"

Mrs. Saugor ignores this. "Wot I want t' say's this: I won't 'ave nobody accusin' me ov starvin' th' child that I won't. Wot d'you think? This very mornin' I 'ears that good-f'r-nothin' piece o' baggage Mrs. Spavin tellin' Mrs. Dock th' besom as I starved me own little Albert afore 'e went into 'orspittle an' Mrs. Dock she says 'W'y! didn't y' know afore? your ears is plugged wiv cotton wool they are' an' then they both larfed fit to break ivery pane o' glass in th' quarters sure's I'm standin' 'ere it's more'n flesh an' blood can endure, the ——s."

"H'm. But—"

"An' 'ere am I givin' th' poor precious th' best ov everything potaters marshed in gravy an' bananers an' Welsh rabbit fit f'r H.R.H. 'imself an' if that's starvin' 'im then me name isn't Cissie Saugor it's Spavin or Dock or some —— tripe like that. Mr. Saugor 'e says 'Go an' tell th' capting' an' a fat lot o' good that'll do I know so I says 'Capting be —— it's th' doctor wot'll make 'em mind their Ps an' Qs' I says and—"

"Oh! you think so? I'm not so sure about that. My first thought is that it may be your own fault. You ought not to have listened to what Mrs. Spavin said to Mrs. Dock."

"Look 'ere, doctor, I ask you . . . an' you knowin' th' meanin' ov 'converted barrack' or 'converted quarter,' or whatever th' blarsted converted wot-d'ye-call-it is an' w'y don't they say 'perverted' and be done wiv th' ruddy contrapshun tell me that? 'Twixt me an' Mrs. Spavin there's a bit o' matchboard that thin y' can see through it without starin' an' twixt Mrs. Spavin an' Mrs. Dock there's another skimpy bit an' if anybody just

so much as whispers it's like th' monsoon 'owlin' through a loud-speaker. Y' wouldn't b'lieve it but I can ackshully 'ear Mrs. Spavin spreadin' th' margarine on th' kids' crusts o' bread—out 'n a tin it is too—an Mrs. Dock 'idin' 'er 'usbands pay in the gramophone funnel come Friday afternoons an' only an hour back w'en I was brushin' me 'air I 'ears Mrs. Spavin shoutin' to Mrs. Dock 'Hi! Lucy, wotcher doin' wiv th' emery paper' an' they both larfed fit to split th' rotten old roof they did and—"

"And my second thought is: that you and your Albert do not attend the Infant Welfare Centre."

"Well now doctor that's a fac' an' truth to tell wot wiv that Spavin baby stripped to th' buff an' fair oozin' Blaxo an' near breakin' th' weighin' machine an' th' Dock brat wiv 'er blue bows an' red nose snifflin' like a railroad injin it's 'nough to give a serpent a fit o' the nerves let alone a—"

"And my third thought is that, as a matter of fact, you were starving Albert before he was admitted."

At this, Mrs. Saugor grasps the handle of the red parasol with both fists, stamps with the right foot, and splutters.

"Yes. To a child of his age, the things you gave acted as powerful emetics and drastic purgatives. You produced a state of starvation—and worse; you poisoned the poor little beggar."

Obviously, Mrs. Saugor is not prepared for an explanatory statement of this kind. Its significance produces in her a frame of mind which the English language is unable to depict. She marches off in quick time and, happily for us, is out of sight before she explodes.

No doubt Mrs. Saugor has her virtues as well as her defects; but they are microscopic. Thank goodness she is an uncommon type.

The office of the O.C., West End, faces the detention hospital. We take refuge therein—after running the gauntlet of all the dogs of all the officers of the 22nd Cuirassiers. These dogs form an amazing pack. Half the breeds are recognizable; but the other half—well—there is no end to the wonders of Nature. It has been alleged that the Cuirassiers' officers are not noted for versatility, but this reproach has never been levelled against their dogs.

The christian names of Captain "Pom" Tote, 22nd Cuirassiers, O.C., West End, are shown in the Army List as "George Henry Harness." Our Station is not provided at public expense with an Army List, although this publication is an absolute essential, even for the home. Everyone here is simple Jim, Jack, Tom or Pom in spite of an elaborate christening ceremony and a careful registration as Edward, Ethlered, Augustus or George Henry. But what could our Godfathers and Godmothers know of us at our baptism? So, in the end, austere Andrew becomes "Crasher" and handsome Harold is dubbed "Punch"; and surely it is better so;

surely an appropriate, recognizable, human name is preferable to a meaningless appellation.

Until Messrs. Thacker sent us an Army List, V.P.P., we were unable to ask anyone to dinner.

The nickname Pom (i.e. Pomeroy) is a delicate allusion to the colour and texture of the skin which covers Captain Tote's face and neck. This integument is thick, tough, tanned, creased and patchy like the outside of a brown crocodile suit case.

Pom is a loose-limbed, bony Australian with a slow smile and a fine set of strong, white teeth. He is a wily fellow and has to be watched. This morning there is a mischievous glint in his grey eyes, indicating that our margin of safety is none too great.

Pom: "Ah! doc., walk in. The very man we want to see. Look—look at this." He points to an open tin full of the soft, saffronized butter we all abhor.

Self (sniffing): "Seems O.K. What's wrong?"

Pom: "Oh! nothing, my dear chap, absolutely nix. They forgot to clean the tin. A slight flavour of paraffin, that's all. Here—taste it. Forward, Q.M.S." Q.M.S. Partworn appears with a knife and half a loaf. You—if you are easily fooled, like me—extract a good dollop of butter from the tin and place it on a morsel of bread which you insert in your mouth. Never do things by halves. If you wish to show Pom, Partworn and Co. that they are making a fuss over a trifle, demonstrate the fact to them thoroughly.

Ugh! the vileness of it. . . .

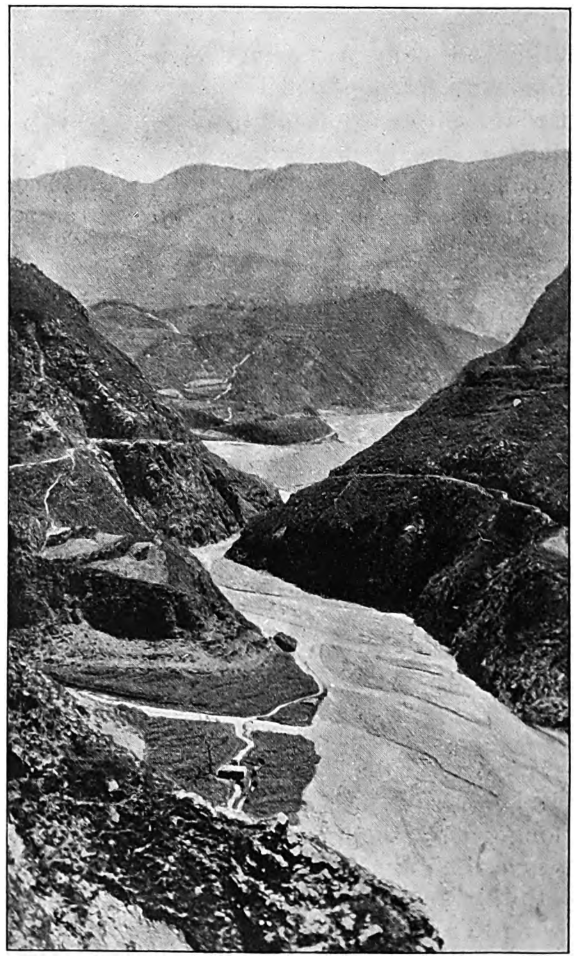
The back of the office abuts on the khud; a quiet, secluded spot in which to be sick.

Accompanied by Pom and his unholy pack, we proceed to the institutes. *En route* we meet Pom's *aide*, Second Lieutenant "Kilo" Curbcheyne of the Royal Horse Marines. Kilo is of course escorted by all the dogs of all the officers, R.H.M. Although this subaltern is only 19, the successful cultivation of a long, wavy, silken moustache of the type favoured by his aristocratic corps gives him the appearance of a man of 29. He is over six feet, broad and burly and rides just under fifteen stone. He is chiefly preoccupied in trying to raise enough money to purchase good ponies up to his weight. This is no easy matter for, in the Royal Horse Marines, polo is a serious business, and none but the best is of any use.

A serious business? THE BUSINESS. Things such as institutes are insignificant side shows; and although even a side show must be well run, yet it remains a side show all the world over; whereas polo—ah! polo is the be-all and end-all of the happy warrior's existence, in the piping times of peace at any rate.

Next to the raising of purchase money for his ponies, Kilo is preoccupied in trying to keep the animals in training for the coming winter

season. At present his stud consists of eight muscular Walers (he says he needs four more!). They require a deal of exercise, and to satisfy this necessity on a knife edge imposes a severe strain on Lieutenant Curbcheyne's time, ingenuity and physique. To his despair Kilo finds that the fitter his ponies become, the keener and more insistent becomes



Ground unsuitable for exercising polo ponies.

his appetite. It is a vicious circle: hard exercise, mountain air, increased combustion, additional fuel; and some of the additional fuel sticks. Up a pound, merciful heaven! and there is no Langenschwalbach hereabouts.

In Our Station no one works harder—physically—than Lieutenant Curbcheyne, R.H.M.

"I do not agree with the general trend of your remarks," you say—or should say: "What about that brilliant and by no means small band of leaders headed by Earl Haig? The British cavalry officer may appear to devote himself heart and soul to polo and hunting: he may appear to take no interest whatever in the serious side of soldiering; but when it comes to solving a professional problem or to action, who is his peer in quickness, decision and common sense?"

To this the answer is, "No one!"

There is no mystery about it: the British cavalry-man, while deceiving the onlooker, contrives even more effectually to deceive himself; and things are not what they seem.

(To be continued.)

ENTERIC FEVERS, DYSENTERY, AND THE ROUTINE EXAMINATION OF MENIALS FOR THE CARRIER CONDITION.

A CIRCULAR ISSUED FROM THE OFFICE OF D.M.S.INDIA.

SECTION I.—*Enteric Group of Fevers.*

THE following observations on the enteric group of fevers amongst British and Indian troops during the year 1929 have been compiled from the Annual Report on the Health of the Army in India and are distributed especially for the information of officers commanding hospitals and officers in medical charge of troops.

The incidence of the enteric group of fevers amongst British other ranks and Indian other ranks for the years 1927, 1928 and 1929 is given in the following table :—

—	British Other Ranks											
	1927				1928				1929			
	Actuals		Ratios		Actuals		Ratios		Actuals		Ratios	
	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.
Typhoid Fever.. ..	30	8	·5	·14	57	13	1·0	·23	102	16	1·8	·29
Paratyphoid Fever A ..	10	—	·2	—	15	—	·3	—	18	—	·3	—
Paratyphoid Fever B ..	8	—	·1	—	7	—	·1	—	—	—	—	—
Paratyphoid Fever C ..	1	—	·0	—	2	—	·0	—	—	—	—	—
Enteric Group.. ..	120	3	2·2	·05	116	5	2·1	·09	113	3	2·0	·05
TOTAL ..	169	11	3·0	·20	197	18	3·5	·32	233	19	4·2	·34

—	Indian Other Ranks											
	1927				1928				1929			
	Actuals		Ratios		Actuals		Ratios		Actuals		Ratios	
	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.	Ads.	Dths.
Typhoid Fever ..	47	4	·4	·03	170	20	1·3	·15	191	25	1·5	·19
Paratyphoid Fever A ..	15	—	·1	—	30	—	·2	—	40	—	3	—
Paratyphoid Fever B ..	6	—	·0	—	11	—	·1	—	9	—	·1	—
Paratyphoid Fever C ..	—	—	—	—	2	—	·0	—	12	2	·1	·02
Enteric Group.. ..	97	5	·7	·04	148	7	1·1	·05	124	6	1·0	·05
TOTAL ..	165	9	1·2	·07	361	27	2·8	·21	376	33	2·9	·26

There has been a distinct increase in the admissions for British troops, largely due to typhoid infection, and among Indian Troops due to typhoid and paratyphoid A and C infections. It is considered that this increase is mainly the result of the increasing liaison between hospitals and laboratories, although there may be an actual increase parallel with that experienced by the civil population of Northern India. This is a matter which can be decided only in time.

The percentage of cases with a short pyrexia among the British troops was striking. Allowing eleven days as the limit for what can be classified as a short pyrexia, the percentage of cases was nearly twice as high as among the Indian troops. Bearing in mind that bronchitis and other lung complications are particularly common in typhoid fever in Indian troops, it is a matter for conjecture whether cases of enteric fever, particularly of a mild type, in this group, are not being missed, the lung complication being given as the final diagnosis, e.g., pneumonia, bronchitis.

Thirty-five per cent of the cases among British troops were classified as mild, the average period of pyrexia being 11·8 days. Of these, 24 suffered from a pyrexia of eleven days or under : 7 cases ran eleven days, 4 cases ran ten days, 3 cases ran nine days, 3 cases ran eight days, 5 cases ran seven days, 1 case ran four days, 1 case ran twenty-four hours primary pyrexia and twelve days later suffered a relapse of forty-eight hours' duration.

The extreme mildness of some of these cases would make it appear likely that cases of abortive typhoid fever among British as well as among Indian troops are overlooked, and it is possible that to such temporary carriers the sporadic outbreaks in units which are the usual experience in most stations are due. As an example of such a case, the following is quoted :—

> "British N.C.O. admitted to hospital, feeling ill with a slight temperature which became normal in twenty-four hours. In five days he was returned to duty feeling quite fit. Twelve days later he returned to the hospital stating he did not feel well. Temperature remained up forty-eight hours, and a blood-culture was therefore taken. Four days later he was discharged to duty feeling quite fit, but owing to his blood-culture proving positive to *B. typhosus*, he was perforce ordered to return to hospital, and despatched to the Hill Depot at Kasauli. Had a blood-culture not been taken, this case would undoubtedly have come under the headache, sandfly, dengue, intestinal, toxæmia, etc., etc., group of cases."

It is interesting to note that among the few P.U.O. case sheets to hand at the moment of writing, a considerable percentage, from a study of temperature charts and pulse rates, could have been placed in this category of abortive or even ambulant enteric group cases.

The bacteriological examination of the stools of kitchen staffs has yielded little help in tracing the source of sporadic cases, and it is possible

that careful bacteriological examination of stools and urine of individuals in the same unit who may have recently suffered from mild pyrexias or even no more than slight indispositions might help to solve what is at present a difficult problem.

It is remarkable that no cases were traced to the carriers discovered among kitchen staffs, etc., examined as a routine measure, although one of the cases was actually a cook in a British Military Hospital, and it would appear probable that more danger is to be apprehended from the ambulant or abortive case, who for a short period may be broadcasting large numbers of typhoid bacilli, than from the chronic carrier, passing only a few bacilli at intermittent periods, although the latter may be more intimately concerned with the preparation and handling of food.

48·6 per cent of the Indian troops cases were classified as mild and ran an average pyrexial period of seventeen days. Of these, 12·6 per cent suffered from a pyrexia of eleven days or under: 2 cases ran eleven days; one case ran ten days; 6 cases ran eight days; 2 cases ran seven days; 3 cases ran six days; 1 case ran five days; 2 cases ran four days; 2 cases ran three days.

There were 4 cases of three- and four- day pyrexia among the Indian troops who showed no symptoms beyond slight fever, and in two of the cases the report of a positive blood-culture necessitated the recall of the patients to hospital after their discharge to duty.

The ambulant case was more common among Indian than British troops. Among the deaths in the former were six which occurred shortly after admission to hospital. In three of these, where a post-mortem examination was made, typhoid ulceration in an advanced stage was found.

Relapses were more common in British troops (10 per cent) than in Indian troops (9·5 per cent). The importance of doing a blood-culture during a relapse is emphasized, as nine such cultures among British cases and thirteen among Indian cases were successful.

By far the greater number of positive cases were diagnosed by blood-culture, 83 out of 100 British, and 157 out of 192 Indian cases. The importance of taking blood-cultures early in the disease was again proved, as 64·2 per cent of the successful blood-cultures in British cases were taken on or before the eighth day, and 86·6 per cent of the successful blood-cultures in Indian cases were taken during this period. The results, however, indicate that where blood-culture has been either omitted or has proved negative in the early stage of the disease, it is still worth while taking blood-cultures at later periods during pyrexia. Positive cultures were obtained from British typhoid cases as late as the twentieth day of disease, and among Indian cases as late as the twenty-third day. It must be realized clearly, however, that the type of case in which positive results may be hoped for is the severer types of typhoid fever, and that the chances of a positive result are much less than in the earlier stages.

Twenty British and forty-two Indian cases were diagnosed by blood-cultures taken after the eighth day. Good results were obtained in certain hospitals by taking two or even three blood-cultures in the early stages of pyrexia. On many occasions the first was negative, and the second or third yielded positive results.

The following classification of the enteric group cases was made :—

BRITISH (103 Cases)	INDIAN (139 Cases)
Severe (20·3 per cent), average pyrexia 24 days.	Severe (24 per cent), average pyrexia 25 days.
Moderate (1·9 per cent), average pyrexia 15 days.	Moderate (1·1 per cent), average pyrexia 28 days.
Mild (77·6 per cent), average pyrexia 14 days.	Mild (75·1 per cent), average pyrexia 18 days.
Of the mild cases 30 per cent suffered from a pyrexia of 11 days or under.	Of the mild cases 14·7 per cent suffered from a pyrexia of 11 days or under.

As regards cultures from the stools and urine, insufficient attention appears to have been paid to the *period* of the illness during which bacteriological examination of stools and urine was most likely to be of advantage. Eighteen cases among the British and forty-two among the Indian groups had no examination during the interval between the tenth and twenty-first day after the onset of fever, although many examinations were made at a later date.

Among the "Group" cases the percentage classed as mild was higher than among the typhoid cases for both British and Indian troops. This is only to be expected, but it is noted that the average period of pyrexia was longer in the Indian "Group" cases than in the Indian typhoid cases. In the British cases the duration of pyrexia was approximately the same in the "Group" and typhoid cases.

As was the case in the proved typhoid cases with a pyrexia of eleven days or under, the Indian troops again showed fewer milder cases of enteric group infection than the British troops. Unless we are to accept the fact that the severity of the disease is greater among Indian than British troops, it seems probable that some of the milder cases are still being lost sight of among the former.

In this connexion it is noted that among the Indian enteric group cases only 56·6 per cent of the total blood-cultures were taken before the seventh day after onset of the disease, and as the history of onset from Indian patients is usually unreliable, it is probable that 56·7 per cent is really an exaggerated figure. From the records available on I.A.F.I.-3056, it is very common to find that the day of reporting sick is recorded as the day of onset of the disease.

The results of Widal tests were satisfactory in that a definite diagnosis in 59·5 per cent of both British and Indian Group cases was made by the test, and an additional diagnosis of enteric group infection on a general rise in standard agglutinin units in a further 28·7 per cent British and 25·8 per cent Indian.

With reference to the remarks on the unsatisfactory specimens of stools

and urine from enteric group cases submitted to laboratories, it is realized that the difficulties in this respect are undoubtedly great, particularly in out-stations, that the majority of the cases are constipated and that Indian subordinate hospital staffs are difficult to impress with the importance of such matters. Paragraphs 4 and 5 of Section C, Appendix XXI, of Regulations for the Medical Services of the Army in India—1930, must be brought to the notice of all medical officers, and assistant- and sub-assistant surgeons.

Cases of paratyphoid A fever, although clinically classified mainly as mild, and without deaths or complications, are very similar to the proved typhoid group as regards average duration of the pyrexia. Fifteen out of 18 British cases were classified as mild (average pyrexia 16 days) and 26 out of 48 Indian cases (average pyrexia 15 days). Of these mild cases, 3 British ran a pyrexia of 11 days or under (1 seven days) and 10 Indian (3 seven days, 1 six days and 1 five days). Had not blood-cultures been taken it is probable that many of these would not have been diagnosed as belonging to the enteric group. It is noticed that the incidence of paratyphoid A among Indian troops, excluding followers, is the same as for British troops, and that the number diagnosed among British troops is increasing year by year (7 cases in 1927, 15 in 1928, 18 in 1929).

Eight cases of paratyphoid B fever were diagnosed among Indian troops, none among British troops. Two of these were classified as severe (average pyrexia 13·5 days) and 6 as mild (average pyrexia 9·8 days). Among the latter was one case with mild dysenteric symptoms who ran a pyrexia of three days' duration. The cases as a whole were definitely milder than in either typhoid or paratyphoid A infections.

Among Indian troops thirteen cases of paratyphoid C infection were discovered. Ten of these occurred in the North-West Frontier Province (eight in one station), but cases were also reported from Nasirabad and Lucknow. There were two deaths, both from a severe concomitant attack of malignant tertian malaria. Apart from these the cases were mild; seven of them showed a pyrexia of seven to ten days, and the remaining four of four days, five days, twelve days, and thirteen days respectively. It would appear unlikely that this infection is limited to Indian troops.

It is probable that a certain number of Salmonella group bacilli other than *B. paratyphosus* B, or C, may be responsible for a percentage of the enteric group cases, particularly those with short pyrexia.

A certain number of agglutination tests were carried out in the laboratories during the year with sera from enteric group cases against specific emulsions of certain of these bacilli, and the results obtained did not appear to indicate that these bacilli were causative agents to any great extent. On the other hand, the tests were not really satisfactory, in that in most cases the test was made only on one occasion, and it is possible that in the milder infections agglutinins may not have been produced in the patients' sera to a diagnostic titre.

A bacillus belonging to this group called *B. morbificans bovis* was isolated from a blood-culture from one such case. This has not been reported as having been isolated in India previously, although in England and America in one or two instances it has been isolated from enteric-like cases.

In both 1928 and 1929 a previously unreported strain of the Salmonella group has been isolated by blood-culture. In 1929 it was isolated from two cases of pyrexia; in one of which the pyrexia was of five days' duration. At the same time and in the same regiment. there occurred thirty cases of pyrexia similar in nature, but being of a mild type and short duration, only three cases which were rather more severe than the others were transferred from camp to hospital. From two of these the bacillus was isolated.

This strain has been forwarded to the Curator of National Type Cultures, Lister Institute, for further investigation.

B. columbensis was isolated from the urine of three cases of continued pyrexia during 1929.

The carrier problem is discussed in Section III of this circular.

SECTION II.—*Dysentery*.

The incidence of dysentery and diarrhœa among British troops for 1928-29 was as follows :—

	1928		1929	
	Actuals	Ratios	Actuals	Ratios
Dysentery	876	15·8	1,039	18·7
Diarrhœa	931	16·5	978	17·6
Colitis	37	0·7	85	0·6

There is thus a definite increase, which may possibly be associated with the increase of intestinal diseases among the civil population for 1929. The severe outbreak of malaria in 1929 in the Punjab and N.W.F. Province may also have had some bearing on this increase, as many hospitals in these areas recorded an increased prevalence of dysentery during the malarial season, a time of year which is usually comparatively free from dysentery infections.

On the other hand, the knowledge of the importance of early investigation of cases of diarrhœa and mild dysenteries is becoming gradually realized by troops and families, and more undoubtedly do report sick than was formerly the case. Also a gradually increasing number of mild cases, which in past years were diagnosed as diarrhœa and treated in barracks, are now admitted to hospital and correctly treated as dysentery.

The relative proportions of the various types of dysentery, definitely diagnosed apart from clinical and group findings, remain much the same as in 1928 for both British and Indian troops, although there is a seven per cent improvement for British troops.

	British troops		Indian troops	
	1928	1929	1928	1929
Protozoal	175	211	77	116
Bacillary	265	388	481	810
Bacillary exudate	—	—	—	296
Clinical..	436	440	1,032	639

The percentage of dysentery cases definitely diagnosed among British cases was 57·6 per cent for 1929, as against 50·2 per cent in 1928, and for Indian troops 55·1 per cent in 1929, as against 54·5 per cent in 1928.

If it is taken that eighty-five per cent of the clinical cases are bacillary infections, we find that eighty-one per cent of the dysentery among British troops and eighty-eight per cent among Indian troops is of this type. Eighty-five per cent is probably not too high a figure because if microscopic examinations in convalescence are carried out as laid down in regulations it is unlikely that many cases passing *Entamœba histolytica* cysts are missed.

The figures for clinical dysentery are however disappointing, as with the facilities now available it was hoped that a larger proportion would be definitely diagnosed. From the clinical point of view however the laboratory returns indicate that an average of fifty-five to sixty per cent of all dysentery specimens from hospitals show microscopically a definite bacillary exudate. This percentage increases to eighty per cent in specimens from certain hospitals in which the medical officer in charge of the cases has been interested in the subject, and has made a point of sending specimens in the early stages of the disease and of selecting mucous as apart from fæcal matter for despatch to the laboratory.

A similar condition of affairs exists as regards the isolation of the infecting bacillus in laboratories. Many D.A.Ds.P. comment on the fact that in quiet times in hospitals they obtain positive results in eighty to ninety per cent of cases, but should a rush of cases occur the percentage positive drops as low as forty per cent.

The average percentage of cases in which dysentery bacilli were isolated from typical bacillary exudates in all laboratories was 58·1 per cent. Taking into consideration all the difficulties which are encountered in obtaining fresh specimens for bacteriological examination this is considered to be a reasonably high percentage. It is hoped that as years go on better figures will be obtained.

The percentage of positive results in certain laboratories in 1929, is quoted as an example of the results obtained.

Laboratory		Cases with bacillary exudates		Percentage in which dysentery bacilli were isolated
Bareilly	..	75	..	94·6 per cent
Lucknow	..	40	..	85 ,,
Kohat	..	167	..	66 ,,
Bannu	..	80	..	80 ,,
Poona	..	91	..	76 ,,
Rawalpindi	..	85	..	71·7 ,,
Bangalore	..	82	..	68 ,,
Lahore	..	164	..	67·6 ,,

The total cases in which a bacillary exudate was present = 2,386. From these cases—

B. dysenteriæ (Flexner) isolated	=	999
B. dysenteriæ (Shiga) isolated	=	197
B. dysenteriæ (Sonne) isolated	=	33
B. dysenteriæ (Schmitz) isolated	=	100
		1,329

These figures are satisfactory in that the causative organism was isolated in 255 cases more than in 1928.

The total admissions to hospital for British and Indian other ranks of bacteriologically proven bacillary dysentery cases from the years 1923-1929 are illuminating as regards the importance of laboratory investigations in this disease.

	British troops	Indian troops
1923	23	15
1924	32	12
1925	85	71
1926	303	280
1927	259	346
1928	265	481
1929	383	810

Bacteriological examinations of specimens of "indefinite exudates" of fæces in convalescence, and from diarrhœa cases (i.e., cases in which neither blood nor mucus was present) gave relatively fewer positive results.

	Indefinite exudate	Examination in convalescence	Diarrhœa cases
B. dysenteriæ (Flexner)	201	143	28
B. dysenteriæ (Shiga)	20	21	3
B. dysenteriæ (Sonne)	13	9	1
B. dysenteriæ (Schmitz)	34	9	3

The difficulty encountered in isolating bacilli of the dysentery group from fæces apart from mucus is generally recognized, and accounts for the somewhat poor results shown above. In addition, many of the so-called indefinite exudates are specimens forwarded from cases several days after the onset of the disease, at which time dysentery bacilli are tending to disappear from the stools; others are due to fæcal matter being included in the specimen in lieu of mucus by the subordinate collecting the specimen. In this connection it may be pointed out that the term mucus as applied to the typical exudate in bacillary cases is almost a misnomer, in that the so-called mucus is largely composed of white blood-cells and is practically clear, sticky "pus." Large endothelial cells and epithelial cells complete the picture, the former accounting to a large extent for the *E. histolytica* of past years. A diagnosis of amœbic dysentery is now rarely made on a finding of "dead amœbæ," but for the benefit of any who may still adhere to the belief that a diagnosis can be established on these grounds, it may be worth while to emphasize the fact that protozoologists are unable to diagnose dead amœbæ unstained (and often not even stained) owing to early degeneration changes in *E. histolytica*, and that *E. histolytica* cysts have practically never been discovered by them in blood and mucus from "acute" dysentery cases.

(*To be continued.*)

Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1929-30.

In the Introduction to their Report the Medical Research Council state that the investigations aided by their funds, like their predecessors, illustrate two clearly distinguishable modes of growth of medical research. On the one hand the sphere of medicine has grown by extension, and has taken into its charge more and more widely all the problems of human life that call for better knowledge of the human body and its functions. On the other hand, medicine has grown intensively, by taking into her service the methods and resources of the primary sciences.

In attempting to delimit the growing territories of medicine, the Council adopt the definition of H.M. Government in settling the respective spheres of action of the Department of Scientific and Industrial Research, of the Medical Research Council and of Agricultural Research. The definition is as follows :—

Medical research deals by no means only with the cause of disease. It deals with the proper development and use of the human body in all conditions of activity and environment, as well as with its protection from disease and accident, and its repair.

As an illustration of the way in which medicine is making use of primary sciences, the Council point to the advancing intimacy in all countries between the ward, the operating theatre and the laboratory. Problems are taken from the ward to the laboratory for solution, while again and again the laboratory independently suggests not only ideas for clinical inquiry, but methods for its pursuit, and even provides therapeutic substances for the immediate use of the clinician.

The laboratories of the universities and the great hospitals are regarded as the workshops of those serving the needs of curative medicine, and of those who increase the powers of preventive medicine.

Accordingly, the present Report shows that by far the greater part of the work the Council aid or initiate is done within the universities or in hospitals serving the universities. In this way the work gains by the opportunity of stimulating and recruiting youth; it also gains by being able to make use of public and private funds without which much of the work described could not be undertaken.

In last year's Report the Council pointed out that a very small part of research work has been done by men engaged in clinical work and studying disease as it actually presents itself in human beings.

The Council have consistently urged not only that there is a science

of experimental medicine or clinical research, but also that the present conditions of hospital organization, combined with other conditions, have impeded its proper development in this country. They are glad to say that in more than one part of the country encouraging co-operation in the work on this special subject is now forthcoming.

At University College Hospital, London, the General Committee has established a Department for Clinical Research to be "under the control of a physician whose special training shall have fitted him for the appointment." Sir Thomas Lewis has resigned his appointment as general physician to the hospital and has been appointed the first physician in charge of this new department. The Medical Research Council welcome this new policy. The changes made in the status of this Department of Clinical Research show that the hospital authorities recognize the value of a research organization maintained side by side with the teaching systems of the hospital but independent of them.

At Leeds the University authorities have expressed a desire to institute a Chair or Department of Experimental Medicine, as soon as the necessary funds can be provided.

At Birmingham plans have been worked out for the erection of a Hospital Centre on a site adjoining the University buildings. A General Hospital, which will be the chief teaching Hospital of the Medical School, is to be erected and arrangements are contemplated for providing full-time positions for clinical research.

At Aberdeen the Regius Professor of Medicine has been freed from the necessity of engaging in practice and is now able to devote his whole time to medical research and teaching. The Professor of Pharmacology, directing a laboratory department, is to be given beds in the New Royal Infirmary. This will reproduce conditions as favourable as at Sheffield, where for the past ten years Professor Mellanby has had charge of forty hospital beds.

For many years the Council have assisted scientific studies that bear on the reduction of maternal mortality. Work on the streptococcal group of bacteria has been in progress for some time at St. Bartholomew's Hospital, Queen Charlotte's Hospital, St. Mary's Hospital and elsewhere, aimed at improving our knowledge of the immunity phenomena of septicæmia and the paths of infection leading to puerperal sepsis. This work has been valuable from the point of view of the prophylactic treatment of the individual and that of the preventive hygiene of labour. Among the streptococci, work by Dr. Colebrook has recently emphasized the dangerous part that may be played by anaerobic forms, which cannot be cultivated in the presence of air and for that reason have escaped detection in the ordinary bacteriological examination.

The Council attach special importance to the study of nutrition and the vitamins, and for efficiency and economy have concentrated the work in a limited number of appropriate laboratories at University centres.

Progress made in the earlier studies of vitamins has led to the production of vitamin A in high degrees of concentration on a large scale. Professor Mellanby has used for his trials of vitamin A in the treatment of puerperal fever a concentrate prepared by Messrs. Lever Brothers.

With the assistance and active co-operation of the late Lord Thomson the Council have arranged in a large section of Royal Air Force personnel for a controlled test of the value of vitamin A in the prevention of colds, or other ailments during the winter months, under various conditions of indoor and outdoor work. Another inquiry has been arranged in co-operation with the medical staff of the London County Council to ascertain the value of vitamin A in the treatment of infective middle ear disease after scarlet fever and in the prevention of dangerous infective sequelæ after the common infective fevers.

During the past year the Council have erected the Dunn Nutritional Laboratory at the Field Laboratories, Cambridge, where researches on the relation of carotene to vitamin A have been carried out. In a previous Editorial we referred to Professor von Euler's work in Sweden ; this worker found that pure recrystallized carotene could effectively replace vitamin A in a diet and was probably stored in the liver. Dr. Moore, working in the Dunn laboratory, has shown that the effects gained with carotene are not due to its being stored in the body or to its identity with vitamin A, but to the fact that carotene in the diet leads to a proportionate appearance of vitamin A as such in the liver. His work strongly suggests that carotene is a precursor of vitamin A and leads to its production within the animal body. The common carrot, though it contains no vitamin A as such, can give rise to the production within the animal body of as much vitamin A as that contained in an equivalent weight, calculated as dry substance, of cod-liver oil.

Progress has recently been made in the standardization of vitamins. Manufacturers have desired to have some standard by which to judge the activity of their preparations, especially vitamin D, and this has led to the appearance of several units of activity. In order to have a common basis of measurement, the Council now maintain at the National Institute a standard solution of irradiated ergosterol for adoption as a standard for the comparative estimation of vitamin D. The unit vitamin D is defined as the anti-rachitic potency of a quantity of this preparation corresponding to 0·0001 mg. of the ergosterol used in its production. Selected methods are recommended for use in the estimation of vitamin D by reference to this standard. Samples of the standard have now been supplied to twenty-eight institutions in Great Britain, and in eight other countries.

Sub-Committees of the Council's Accessory Food Factors Committee have been formed to further the studies necessary for the establishment of standards for vitamins A, B, and C respectively.

During the past year, Mr. Clifford Dobell has completed his studies at the National Institute of the *Entamœba histolytica*, and details of the work which has occupied him for six years are now being published. The

natural infections of three species of *Macacus* monkey by this entamœba have been investigated, and Mr. Dobell has found that in all its structural and cultural characters it is identical with the *E. histolytica* in man. He has been able to isolate any desired strain of the entamœba from a man or a monkey, and to maintain it in artificial culture for any period; to obtain any stage in its life-history—for instance, encystment—in the laboratory at any chosen time; to introduce it naturally to any fresh simian host; and to eradicate it at will by therapeutic means.

In 1913 and 1914 Professor Stockard, in America, published the results of his experiments on guinea-pigs, which seemed to show that the daily administration of alcohol in doses sufficient to cause visible intoxication, but not otherwise to impair the vitality or health of the parents, caused a fall in the number of births, an increased liability to still-births, and the production of weakly and defective offspring. The evidence appeared to show that these tendencies were inherited, and without further exposure of the stock to alcohol the proportion of animals showing weakness and deformity continued to be high in later generations. In later papers Professor Stockard suggested that a process of natural selection ultimately corrected this tendency and established a stronger stock from the survivors.

At the time Professor Stockard's experiments were made the constituents of a diet necessary for full health and normal reproduction were not so well known as they are to-day. In view of the importance of the subject it was considered advisable to repeat Professor Stockard's work with critical care on animals whose diet was standardized and contained sufficient of the essential vitamins.

A small group of healthy guinea-pigs at the National Institute was chosen about nine years ago, and a stock maintained by inbreeding from these. In each generation a number of males and females have been exposed daily to alcohol, the dosage and method of administration being made to follow Stockard's description exactly. Adequate numbers of control animals were kept and observed under identical conditions, except for the absence of treatment with alcohol. The offspring from each mating have been carefully examined and weighed, and further generations have been bred from those of alcoholic parentage, with or without further exposure to alcohol. The diet has been carefully standardized for the whole stock and essential vitamins provided.

Miss Durham has conducted the experiments, which entailed many years of labour, and on no essential point has she been able to confirm Professor Stockard's results. The litters obtained from the alcoholic parents have been as numerous and as heavy as those from control matings, and have shown no excess of still-births or deformities. Their offspring for several generations have exhibited no transmitted defects of the kind described by Stockard.

The Council say it is safe to conclude that alcohol by itself cannot produce Professor Stockard's results, and the conclusions which have been

based upon them, as to the effects of parental alcohol on the genetic qualities of a race, cannot be upheld. "It is hardly necessary to point out that these negative findings have no relation whatever to the effects of alcoholic parentage on the upbringing of children in an organized human society."

In connection with the national supply of insulin the Council point out that after Banting's discovery in 1922 they took an active part in promoting the manufacture and clinical use of insulin in Great Britain. For a few months the supply was unable to meet the sudden increased demands that the success in treatment created. In 1923, however, the supply was in excess of the physicians' demands and it was expected that the consumption would rapidly rise to a maximum commensurate with the estimated number of sufferers from diabetes. There has been a steady increase in consumption, and in 1930 the demand for insulin was four times greater than in 1925. The Council consider that there is no escape from the conclusion that very many patients in 1925 were not getting the benefits of insulin, and that the present demand does not correspond with the number of diabetic patients in the country. They think that many patients are not receiving insulin under proper conditions of biochemical control and diabetic balance, for there is a remarkable discrepancy between the long proved success of insulin treatment in skilled hands at the chief medical centres and the apparent steadiness of the death rates from diabetes recorded for the country as a whole. Insulin does not effect a radical cure but prolongs life, and if it had been adequately given there should have been a fall in the deaths from diabetes at earlier ages. This has in fact occurred, but not to the extent that would have been expected if the use of insulin during the past few years had been brought to its present level. The Council consider it is their duty to bring these facts to notice. They propose during the coming year to inquire into the results of insulin treatment at special centres with a view to ascertaining the standard of success attainable under the best conditions. They believe this will give a better means of measuring the results obtained for the country as a whole.

At the National Institute for Medical Research virus infections have been studied. Captain Douglas and Dr. Wilson Smith have found that the blood and tissue cells of a normal animal have a limited power of killing virus outside the body, and this appears to be due to a normal constituent of the serum which is easily destroyed by heat.

The question of the intimacy of the union between a serum antibody and the corresponding virus has been studied by Dr. Wilson Smith, who has found in the case of the viruses of vaccinia and herpes that each absorbs from a mixture its own specific antibody and removes it from the solution in which the other remains intact. Dr. Todd observed that the union between virus and antibody was at first labile and the mixture could be again rendered infective by mere dilution. Dr. Andrewes found that the union became firmer with time, so that on long standing a mixture no

longer became infective on dilution. The completion of a firm union required many days at room temperature, which is in marked contrast to the immediate insusceptibility to a virus conferred by the injection of a specific antibody into a living animal. It is suggested that some relation of the humoral antibody to the living cells must be involved and this has been studied by Dr. Andrewes by the method of artificial tissue culture. He has found that the herpes virus is prevented from infecting normal cells when these are cultivated in the presence of an immune serum; on the other hand, cells from an animal immunized to herpes, if grown in normal serum, are susceptible to infection by the virus.

Dr. Wilson Smith has investigated the herpes virus in relation to its power of becoming adapted to infection of the skin on the one hand, or of the brain and nervous tissues on the other. He has taken a neurotropic strain of the virus, having no power of causing skin reactions, and by repeated testicular inoculations has so modified it that it now infects the skin and produces reactions, even in high dilutions.

Dr. Andrewes and Dr. Carmichael have studied the relations between the herpes virus and encephalitis lethargica, which has been attributed to a herpes virus adapted to infect the brain of man. They have found no support for this suggestion.

Dr. Laidlaw and Mr. Dunkin have continued their researches on canine distemper. They have found that an effective serum can be prepared by repeated injections into a dog already immune, and that the optimum course of immunization can be found by means of the complement-fixation test of the serum. They have prepared a serum of such high protective value that 10 c.c. will prevent an attack of distemper if given in the incubation period after infection, and will cut short an attack if given during the early feverish reaction. If this serum is given to a healthy animal and active virus is injected at the same time into a different part of the body, a durable immunity to subsequent infection results. The whole process of immunization can thus be done on a single occasion.

Dr. Andrewes has been studying malignant tumours made available by Dr. Gye's work. He has found that fowls which have been affected for some time with a slowly growing fibro-sarcoma, to the spread of which the organism offers considerable resistance, have a blood serum rich in antibodies and that these neutralize the infective property of filtrates from rapidly growing fowl tumours of quite different histological types. This evidence that the infective agents producing fowl tumours of quite different histological type may be antigenetically similar, is very significant.

Dr. Elford has made substantial progress towards the production of graded "ultra-filters" and has now been able to make a collodion filter which will stop even the smallest visible organisms and allow a particular virus to pass; and also a filter which will allow the proteins in solution to pass and hold back the virus. A virus can thus be concentrated and its infective properties increased.

Some years ago the effects of insulin were studied on a simplified physiological system in which the passive muscles were supplied with a natural blood circulation and artificial respiration. The results obtained appeared to show that under these conditions the effects of insulin were practically limited to the removal of glucose from the blood and its deposit as glycogen in the muscles. More recent evidence indicated another factor in the action of adrenalin which is known to be secreted into the blood when this is depleted of glucose by the action of insulin, and was believed to cause a discharge of glycogen from the muscles in the form of lactic acid. Dr. Corkill's experiments have shown that adrenalin does cause the discharge of glycogen from the muscles in the form of lactic acid, but the amount formed accounts for only a part of the glycogen lost. The effects of adrenalin and insulin are not directly antagonistic. When they are present together insulin still converts circulating glucose into muscle glycogen which adrenalin concurrently removes, so by the combined action carbohydrate disappears.

Some sixty pages of the Council's Report are devoted to the research work carried on in the various universities, hospitals and the laboratories connected with them. A cursory glance through these pages reveals the wide field of work now being financed by the Medical Research Council. In the space at our disposal it is impossible to give details of this work; in many cases only the nature of the research, the names of the workers, and the papers already published are given.

The Report, like its predecessors, is a very valuable contribution to medical science and should be carefully studied by all research workers.

Clinical and other Notes.

TWO CASES OF INFANTILE KALA-AZAR.

By Major J. B. A. WIGMORE,

and

Major W. M. CAMERON, O.B.E.,

Royal Army Medical Corps.

The ætiology and the diagnosis of the following cases are of sufficient interest to make them worthy of record.

On May 17, 1930, a small boy, F. H., aged $2\frac{3}{4}$ years, was admitted to the Families Section of the Military Hospital, Moascar, suffering from

general malaise and debility with occasional evening pyrexia of mild degree of a few weeks' duration.

His history was as follows: He was born in Malta in October, 1927, and came to Egypt in December, 1928. Shortly after his arrival in Egypt, he was admitted to hospital with bronchopneumonia, but from that time had no further illness until his mother noticed his gradual decline in health in May, 1930. His admission to hospital in 1928 is of importance, as owing

to the obvious nature of the physical signs of his present disease, it would suggest that he acquired this disease during his residence in Egypt.

His family history is of interest. His mother and one brother were healthy, but his father gave a history of chronic malaria contracted in India and was last in hospital in Malta in 1928. Physical examination of the father revealed nothing abnormal. His sister K. H., aged 5 years, was found to have a similar condition, and was admitted to hospital on June 17, 1930. The physical signs discovered were common to both children and their appearance was very much the same.

The children were well nourished, but very pallid and flabby looking; the skin was clear and there were no signs of pigmentation or of jaundice. The abdomen was protuberant, but there was no ascites though the superficial veins were somewhat dilated, and examination revealed a greatly enlarged liver and spleen. The liver in the case of the boy extended four finger-breadths below the costal margin in the supine position, and the spleen was enormously enlarged, extending down to the left iliac fossa, vide photograph. Both organs on palpation felt smooth and moderately soft, and there was no complaint of pain or tenderness.

In the case of K. H., the organs felt distinctly firmer. No enlarged glands were palpable.

Physical examination of other systems was negative.

While in hospital the children had an irregular and mild evening temperature (100° F.), which did not show any characteristic double remission in the twenty-four hours, and they became increasingly debilitated and anæmic.

The following investigations were carried out :—

(1) Repeated blood-smear examinations were negative for malaria.

(2) Fragility tests of red blood-cells gave normal results.

(3) Test for urobilin in the urine was negative.

(4) Wassermann reaction was negative.

The following blood examinations were carried out on F. H.:—

	May 17, 1930	May 20, 1930	June 1, 1930
Total R.B.C.s	5,240,000	4,300,000	4,670,000
Total leucocytes	7,187	8,750	7,300
Hæmoglobin	90 per cent	80 per cent	80 per cent
Colour index	0·86	0·93	0·90
Polymorphs.	1·5 per cent	16 per cent	25 per cent
Lymphocytes	66·5 ,,	67 ,,	59 ,,
Large monos	31·5 ,,	15 ,,	14 ,,
Eosinophils	0·5 ,,	2 ,,	2 ,,

A blood-count on K. H. revealed a more definite anæmia with leucopenia, thus :—

	May 17, 1930
Total R.B.C.s	3,860,000
Total leucocytes	2,775
Hæmoglobin	65 per cent
Colour index	0·85
Polymorphs.	15 per cent
Lymphocytes	75 ,,
Large monos	10 ,,

To summarize the diagnostic problem, therefore, these were cases of splenomegaly with enlarged liver occurring in two children of the same family in Egypt, mildly febrile, and showing a blood-picture of mild anæmia with a definite lymphocytosis and a large mononuclear increase, but no abnormal cells or leucocytosis.

The differential diagnosis of an enlarged spleen with an enlarged liver in childhood presents many possibilities; they may be grouped as follows:—

(1) Splenomegaly associated with chronic infections, e.g., tuberculosis, syphilis, lymphadenoma.

(2) Splenomegaly associated with blood disease, e.g., acute leukæmia, myeloid and lymphatic, splenic anæmia, and pernicious anæmia.

(3) Splenomegaly associated with cirrhosis of the liver, e.g., Banti's disease and splenomegaly with biliary cirrhosis.

(4) Familial splenomegaly—Gaucher's disease and acholuric jaundice.

(5) Tropical splenomegaly—kala-azar and malaria.

It will be seen from the above investigations, without going into the differential diagnosis in detail, that the cases were probably: (1) Splenic anæmia infantum; (2) Gaucher's disease; (3) kala-azar.

To consider these three more fully is not without interest.

Splenic anæmia infantum or von Jaksch's anæmia pseudo-leukæmica infantum should be definitely differentiated from the juvenile form of the chronic splenic anæmia of adults. True splenic anæmia practically never occurs in infancy; in addition, the anæmia in these cases is hardly severe enough. The splenic anæmia infantum has a characteristic blood-picture: great reduction of the red cells and hæmoglobin percentage, a leucocytosis up to 30,000 with lymphocytic increase, the presence of nucleated red cells, and a constant myelæmia up to six per cent [1]. Further, Hutchison states that it is confined to the first three years of life and should not be diagnosed after that period.

Finally, it is a rare disease and becoming rarer [2].

Gaucher's disease first described in 1882 is now considered to be a special change in the reticulo-endothelial system. It is a rare disease; in 1924 Connor [3] collected records of only twenty-four cases.

The cases under discussion conform to its main features which are: its occurrence in childhood in several members of one family, and the great enlargement of the spleen without interference to any great extent with the general health. Two features generally described were, however, absent: (1) a yellowish wedge-shaped thickening of the conjunctivæ on both sides of the cornea, and (2) a brownish yellow discoloration in the areas of the skin exposed to light. The only method of making an accurate diagnosis is by demonstrating by splenic puncture the large mononuclear endothelial cells, which are present in the spleen, the liver marrow, and lymphatic glands in this disease.

Kala-azar. The cases presented almost all the features, the remittent irregular temperature—though there was no double rise in twenty-four

hours—the splenomegaly and enlargement of the liver and the blood-picture. Archibald [4] points out that a splenomegaly and a blood-picture showing anæmia with a proportionate reduction of hæmoglobin, a marked leucopenia with a reduction of polymorphonuclears and eosinophiles, and a relative increase of lymphocytes and large mononuclears is almost diagnostic of this disease. Only one of the children, K. H., really gave such a picture; but in infantile kala-azar the leucopenia is often not evident. This appeared to be the most probable diagnosis, but against it was the fact that kala-azar was said to be unknown in Egypt, and the long period, eighteen months, which had elapsed since leaving Malta made it improbable that the disease could have been acquired there.

On July 5, 1930, one of the authors (W.M.C.) saw the cases and performed a splenic puncture on the boy, F. H. Leishman-Donovan bodies were present in large numbers in the smear from the splenic pulp, but were not found in the peripheral blood. The cases were treated with "Fouadin," which has met with considerable success in Egypt in the treatment of bilharziasis in children. The dosage was 1·25 cubic centimetres every alternate day for all injections in the case of the boy, and ten injections of two cubic centimetres in the case of the girl. No improvement was noted and they were invalided to the United Kingdom on August 11, 1930.

As the diagnosis was now certain, we endeavoured to ascertain the actual incidence of kala-azar in Egypt. The Public Health authorities stated that no cases of kala-azar in Egypt had been reported for some years, but during the last ten years they could trace forty-five cases of leishmaniasis, this diagnosis being inclusive of tropical sore. These were sporadic cases and most probably did not arise in Egypt. Archibald records only two cases in Egypt, and Stitt says the disease does not occur in Egypt. We were also informed that there is no record of a case of kala-azar being admitted to the Kasr-el-Aini Hospital, Cairo, but that there were cases of cutaneous leishmaniasis reported in an endemic area in the neighbourhood of Kantara near the Suez Canal.

On the other hand, A. Panayatatou [5] reported a case in Alexandria in 1929, making the fourth case he has seen; the other three cases were reported by the same author in 1922. The disease is, however, one of definite rarity in Egypt. The incubation period of the disease is vague; the shortest definite incubation period is ten days recorded by Manson [6]. Manson-Bahr thinks that the disease may remain latent for a long period, but the general opinion would appear to be that the incubation period is less than six months. In these cases the incubation period would appear to be eighteen months, if the disease was acquired in Malta. We incline to the view that such was the case, and that the condition was kala-azar infantum acquired in Malta and remaining latent for eighteen months in Egypt. The absence of any other cases in the area would appear to confirm this view.

We have pleasure in acknowledging our debt to Major G. Shaw, R.A.M.C., who was in medical charge of the cases and carried out the treatment. He supplied the notes and the history charts, etc., which enabled us to publish the cases.

We have also to thank the D.D.M.S., B.T.E., Colonel J. T. Johnson, D.S.O., for permission to publish the cases.

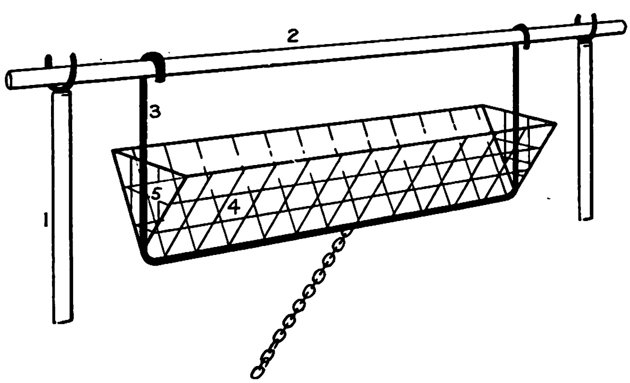
REFERENCES.

[1] Rolleston, Sir Humphry. *Brit Med. Journ.*, December 12, 1925, p. 1099.
[2] Hutchison, Robert. *Ibid.*, August 18 1928. p. 281.
[3] Connor. *Boston Med. and Surg. Journ.*, 1924.
[4] Byam and Archibald. "Practise of Medicine in the Tropics," xi, 1444.
[5] Panayatatou, A. *Brit. Journ. Children's Diseases*, 1929. xxvi, 112-115.
[6] Manson's "Tropical Diseases," 7th Edition, 154.

COLLAPSIBLE SWING INCINERATOR.

By Major J. C. CHUKERBUTI,
Indian Medical Service.

This incinerator was first used in 1922 in Saidgi, North West Frontier Province of India, and was found to burn litter more quickly than the usual fixed varieties. An incinerator of the size described is capable of burning daily the litter of a cavalry regiment. A smaller model was tested at the British Military Hospital, Secunderabad, and was found to be satisfactory.



Component Parts.—(1) Two posts, six feet long, one end having a metal U-shaped piece, the other end being pointed. The pointed ends are driven into the ground, the posts being about ten feet apart.

(2) A bar, round in section and about eleven feet long, the ends of which rest on the upright posts.

(3) A metal bar bent in a flattened U-shape, the base being straight

and nine feet long, the ends perpendicular to the base, with the extremities bent to form a hook so that the U-piece can be supported on the horizontal bar and can swing freely on it.

(4) Two rectangular metal grids, nine feet by four feet.

(5) Four triangular metal grids.

The two rectangular grids are attached to the base of the U-shaped piece by iron rings, and the triangular grids are attached, apex downwards, two to each of the upright arms of the U.

By means of wire fasteners the ends of the large grids are attached to the triangular grids, so forming a V-shaped trough, and when it is desired to transport the apparatus, these fasteners are removed and the grids fold flat.

A chain is attached to the centre of the horizontal limb of the U-shaped bar, and by it the trough can be swung like a punkah, the swinging causing greatly increased draught and rapid incineration.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (Ret.).

(*Continued from p.* 390.)

We landed in January on a cold wintry morning and proceeded to London. The next day I reported myself at the War Office and was received by the Director-General, Sir Thomas Crawford, K.C.B. He was particularly gracious and kind, and told me that I would be posted to Aldershot for a course of drill and ambulance instruction, and added that he had selected me to relieve Lees Hall as Adjutant of the Volunteer Medical Staff Corps in six months time.

Two months later I found myself in the North Camp at Aldershot. Surgeon-Major Rae was in charge, and doing duty were Saunders, Cardozo and Pool. A month later I was on the square drilling in the South Camp.

Surgeon-Major W. Johnston commanded the Depôt. He was a distinguished officer, who with Surgeon-Major Don did much of the spade work for Sir Thomas Crawford and their work prepared the way for the Regulations of to-day.

Surgeon-Major W. Briggs Allin was the senior instructor and about the keenest soldier I ever met. His assistant was Surgeon J. Falvey, who had distinguished himself at the siege of Lydenburg in 1881. He was a genial Irishman but very quiet, and I recollect editing his thesis for promotion. Our Mess was established in a hut before the present building was taken

into use. James Andrew Clark (now Sir James Andrew Clark, Bart.) was one of us. A fire-eating Irishman, named Barrington, was another. Our senior dining member was Brigade-Surgeon Beaufort Scott. He was a very handsome man who always turned out spic and span, possessed a gentle and cultured voice and was much liked. He had been employed in 1878 to recover the body of H.I.H. The Prince Imperial, and the result was a warm friendship between the Empress and Scott.

Those were strenuous days at Aldershot and when the work was over we were tired. At last my orders directing me to report in London arrived.

In India I had taken an interest in Ambulance Transport and now it began to take some shape. I joined the Royal United Service Institution, and embarked on a course of battle reading in relation to the casualties. The library helped me; indeed I was a member till last year, nearly forty years. I have often regretted my brother officers were not more interested in it. Young officers are always treated well and considerately there, and it was a real inspiration to hear the most distinguished admirals, generals and others speaking on various subjects. I also was a reader at the British Museum, and attended as often as I could lectures at the Royal Institution and the School of Mines. I am sure I gained much by this practice.

During my first six months with the V.M.S.C. I followed on the lines laid down by my predecessor, Lees Hall, who was very popular and had everything in good order. He is remembered by the magnificent staff he gave the Bugle Major.

Although I never served with Sir James Cantlie, it would seem disloyal not to mention how much the V.M.S.C. owed to that distinguished gentleman. He organized the Corps and was the first Commandant. When I joined, Mr. Norton of St. Mary's Hospital was the Commandant; Surgeon-Major Platt was second in command; Dr. J. E. Squire was the senior captain, a keen volunteer and full of ideas.

Surgeon-General Slaughter, the elder of two brothers, was the P.M.O. He was a bachelor and had a place in Hampshire. He was succeeded by Surgeon-General Lewer who inspected the V.M.S.C. at Chelsea Barracks that year.

William Wellington Lake was a Captain in the V.M.S.C. He was a splendid fellow, and we all loved him. He was tall, with a kind smiling face and always full of fun. He told me that his mother wished him to be christened "Waterloo," because he was born on that day, but his father desired "Wellington." Lake was a very practical soldier, and had seen service in the Russo-Turkish and Serbian Wars, also in Egypt and elsewhere. He wore a string of medals and orders.

Mr. D'Arcy Power (now Sir D'Arcy Power) was another favourite. He was the son of Sir Henry Power, the surgeon and examiner whom all students liked. He was a gentle, kind man who gave us confidence at those

trying times. D'Arcy Power was a "chip of the old block," with the most engaging ways, and performed his duties faultlessly. He is now in the first rank of the profession. Sims Woodhead was one of us, and perhaps Sherrington of St. Thomas's has not forgotten the part he played in the Corps. I know he backed the volunteers well.

We assembled at Folkestone for Easter manœuvres and settled into camp near the Leas. On my way down I met Captain Drummond of the Scots Guards, who, I think, was acting Brigade Major, and he asked me to dinner. Here I met "Wattie" Beevor of my Service and then attached to the Scots Guards as their M.O. He was an indefatigable worker, a good friend, and one of the best gentleman riders of the day. I shall have to refer to him again. Easter Monday was the day for the battle. Crowds came out to see us die as we carried our side to victory. The decisions of the umpires were generally worded so cleverly that a victory in some part of the field occurred to both sides.

Our corps had to be split up for the battle and I had to arrange this in consultation with various staff officers, so had to cover a lot of ground. I came across Lake with his company waiting for casualties. He was having an animated conversation with some farmers as he sat on a gate and they smoked his cigars. He was not fussing, but I knew would meet any casualty coming his way. In the meantime it began to rain in torrents and the day was spoiled. Still the battle raged furiously till lunch time. I made for our headquarters and found the first Tortoise Tent I had ever seen pitched, but not trenched, so I called the men to get their spades out and trench or we should be swamped, but they responded very feebly. I shouted, "Isn't there a man to tackle this job?" and I was going to start myself, after the mare was arranged for. A handsome, soldierly-looking person in civil clothes seized a spade and soon got the trenching done. I thanked him and asked him into the Mess tent. This was Brooke Greville, one of my best friends from that day, though I have seen nothing of him for a long time. He was in the Foreign Office when I heard of him last, and I expect found it congenial as he was a very fine linguist. It transpired that Greville was representing the makers of the Tortoise Tent. This was a remarkable invention of Captain A. Saville Tomkins, who had fought through the Garibaldian Campaign. He was a City merchant, an ardent volunteer, with a very inventive mind. His tent eclipsed all others and was reported as the best at that date.

In the summer of 1890 I was invited to become a member of the Committee of the Royal Military Exhibition at Chelsea, and was entrusted with the arrangements of the Ambulance Section. It was here I first met Sir John Furley, one of the most distinguished pioneers of the Red Cross movement of the century. He had a great war record extending back to the Franco-German War of 1870.

A length of building of 120 yards was allotted to me and I set to work. I first enlisted the help of Mr. John Tussaud to give me the figures for a

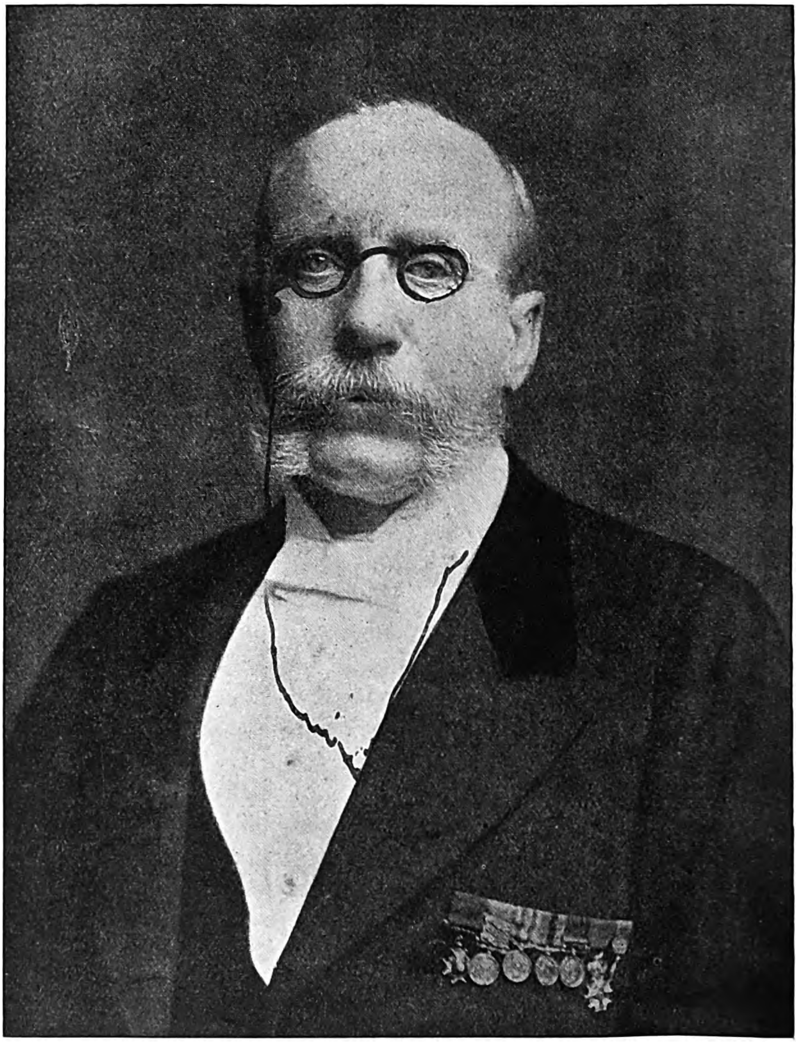
Dressing Station. I went to the Doll's Hospital and entered into arrangements for figures and busts, which I dressed up in various uniforms and pitched them about on the prospective field of battle till they were killed or dying. Mr. Roland Ward supplied the lines of communication with animals, in the forefront of which was an elephant. Mr. Ward said to me, "I am afraid the elephant will not do as he is charging with his trunk in the air." This beast had been shown in the recent Colonial Exhibition with a tiger on its head, and fighting. However, after thinking, Mr. Ward said, "I can alter the eye, and you can put some grass by his trunk and I hope it will be successful." He also lent me three camels and many yards of suitable scenery. It only remained to fetch the elephant from his stores at the docks. Greville undertook to bring this animal up, and I only wish I could tell the story as he did. It was like this. Having procured a lorry from some contractor, the elephant was slung on to it, and in the late afternoon the procession began. It was more or less a triumphal march. The spectators cheered or jeered, horses shied at the huge beast with his threatening proboscis, and when they reached Whitechapel some doubtful witticisms were levelled at the "show." Speed was increased in the respectable City and under the shade of St. Paul's. Eventually it arrived at the Criterion for a rest and refreshment. Soon they started again with wild yells and shouts from a host of amused people, and finally brought up at Chelsea in the small hours and a wall had to be taken down to admit the beast. It must have been exciting and funny. The next day the elephant took its place and behaved very well through the season.

My show started with an entrenched position at the front with dead and injured lying indiscriminately about and bearers applying first aid with the aid of a "*hairy*" or a F.M. companion. Then followed transport to the Collecting Station, supplemented by hand seats to the Dressing Station. This was an artistic piece of work, with a beautiful nurse, who well represented the Nursing Service. After this came the Lines of Communication, showing every form of transport to the rail-head, and there Zavodovsky, like the old man from the sea, appeared. It was a very complete picture.

Her Majesty the Queen intimated her intention of visiting the Exhibition and arrived in a bath chair escorted by His Royal Highness the Duke of Connaught. We were in review order of dress, and when the Queen reached my place I was ordered to tell my story. I gave a brief ambulance lecture to which Her Majesty listened. When I had finished I saluted once more, and was told that the Duke said, "There, mother, you know all about it." It was a great day for me as I had lived many years with my grandfather, who was Clerk of the Works, and for forty years had quarters in St. James's Palace. He had filled me with great ideas of Royalty and loyalty. I hope they are no less now and, I may add, I am certain they are not.

The Military Exhibition was a great success in all its aspects. It did not make a lot of money, but it stimulated the finest patriotism. The

collection of pictures was exceedingly good and everything was carried out thoroughly and unostentatiously. The Ambulance Section came in for very kind criticism. I gained all kinds of ideas and did not reckon how near I was to getting my foot on the first rung of success. This year



Sir William Mackinnon, K.C.B., D.G.

I read a paper at the Royal United Institution on the "*Transport of Wounded in War.*" I took meticulous care in its preparation. General Goodenough was in the chair and a discussion followed which proved so instructive that another afternoon was given to it. Sir John Furley, Sir Vincent Barrington, Maclure, Platt and many others took part.

Surgeon-General Sir William Mackinnon, K.C.B., was now in the chair, at 18, Victoria Street, the headquarters of the Medical Services. He was always kind to me, and while I was Adjutant of the V.M.S.C., took a great interest in it.

My lecture at the Institution came to the notice of Sir Thomas Longmore. He invited me to bring out a new edition of his "Treatise on Ambulance," if the D.G. approved. Sir William most cordially approved and I commenced getting my notes in order, and also had the fortune to be advised and assisted by Sir John Furley. He wrote the chapter on the Red Cross, Surgeon-Major W. Johnston the article on the A.M.S., and I did the rest. The book has disappeared into the limbo of the past.

It was this year that Koch startled the world with his cure for tuberculosis, under the *ægis* of the German Emperor. At this time I received an invitation to visit Paris, Vienna and Berlin, and was given the leave on condition that I reported on the cases I saw, and I was also given facilities to examine all the latest inventions in ambulance transport. I was fortified with introductions, and in November, Tomkins, Roos and I left Charing Cross for the Continent.

Paris was our first stop. I called on the Comte de Beaufort, President of the French Red Cross, armed with an introduction from Sir John Furley. I was ushered into a waiting-room, and asked to excuse delay, as the Comte was unexpectedly detained with the President of the Republic. I could hear them talking and about to separate. Suddenly, out came Marshal MacMahon. He was a big man with a high colour. I came to attention and bowed, but he did not see me. I then saw the Comte de Beaufort, who was most pleasant. We discussed the Algerian mule, and I hardly know in what connection, probably mule carriage for the sick. He gave me some addresses to see material, etc. The next three days I spent in examining the newest inventions of the French army, which included the first field dressing, Maggi's consomme, and an enormous searchlight on a wagon to light up battlefields when searching for wounded.

We left Paris, and after a cold tedious journey arrived at Berlin, and settled down in the Frederick Strasse Hotel.

The next day I called on the D.G., General Stabs-Arzt von Coler. I was not in the least impressed by his mysterious air, and compared with my D.G. he was nowhere. I also left a card on Werner, his Staff Officer. Now this officer had been in England and had been entertained all the time by us, so I really expected to meet a versatile, sympathetic man who would help, but I was disappointed. He asked the medical officer of the Potsdam Guards to show me his place, so I called on him and met a friendly, decent German. He took me to the regiment and I saw a little, but nothing worthy of record.

I went to Bergman's clinic. On my way I saw the Kaiser driving along the Unter den Linden. He looked as alert and restless as ever and was driving very fast. I must give him his due, and remark that he knew

the way to play the Emperor from the picturesque point of view. I spent some time at the clinic, but saw nothing out of the way, so passed on and called on Professor Golterman, and found him weak and recovering from "flu."

The afternoon I spent at Dr. Ewald's clinic, and saw cases which had been treated by tuberculin.

Having heard nothing from von Coler, I determined to move on to Vienna as soon as Tommy aud Roos could leave, and at breakfast I told the hotel that I would leave that evening. At 3 p.m. an orderly rode up and handed me a letter telling me in so many words that Berlin medical affairs were at my feet, and that I could commence the next day but should call at the office first. I believe they started all this when they heard I was leaving. I replied to the letter and thanked the D.G., and told him I had seen a good deal, and regretted that I could not change my plans. There my German experience ended.

I must introduce my friend, Gustaf Roos, a handsome man and a courtier, whose father, a Swede, had married an English lady. Roos also married an English lady, and they were the parents of the late distinguished warden of the Indian marches in the Khyber, Sir George Roos Keppel. Gustaf Roos had enjoyed a long experience as agent for Nordenfeldt and other big firms on the Continent, and was familiar with almost every Court in Europe, of which he wrote a most interesting story. In addition, he was a charming, agreeable, and interesting companion. He is 90 years old to-day, and I hope to see him again.

Our feelings were mixed when we left Berlin by the evening mail for Vienna. It was too early to dine before starting, so we decided to do so at Dresden, where we were again disappointed as the train was two hours late. We did not get anything to eat till we reached Pilsen on the Bohemian frontier. It was a cold, clear frosty night, and here Roos foraged and procured some sausage and bread which we washed down with Pilsener beer. The next morning found us at Vienna and at the Granville Hotel.

The chief letter of introduction I had was from Sir John Furley to the Baron Mundy. The Baron was a Hungarian of aristocratic lineage, who in his younger days was in the army, and was a staff officer at the battle of Königgrätz. He told me some of the details of that campaign which ended so disastrously for Austria. Retiring as a comparatively young man, he devoted his life and wealth to ambulance work. He was evidently under the magical influence of "Le Souvenir de Solferino," written by Henri Dunant many years before, whose work under Furley and many others was taking a definite form. Later, he took up with the same enthusiasm, "First Aid to the Sick and Injured in Civil Life," and organized at Vienna the "Wiener Frieiwilliger Rettungs Gesellschaft." He built a depot, equipped it and personally supervised it, and lived on the premises. I can see him now burning with zeal in his work, which was of a very complete and thorough nature.

I had the pleasure of being asked to Professor Billroth's clinic and I saw him operate. He showed some interesting cases and made some very shrewd observations. He also invited us to his schloss outside Vienna where we spent a pleasant afternoon with him, during which he played the violin. I spent all the time I could spare looking at the beautiful city. I saw the Hofburg, but could not get inside; the church of St. Stephan, the Votive Church and a church parade; the Imperial Stables, and went out to Schönbrunn where two years earlier the tragedy of the Crown Prince Rudolph had been enacted. I visited some gardens in the late afternoon and saw some excellent skating, and skated myself. It was odd seeing officers in uniform on the ice, but it made a very pretty picture and they all skated well.

We met a number of pleasant people, and before we left Tommy gave a dinner party to our special friends. We returned to England just before Christmas, and early in the year I lectured at the Cambridge Hospital on all I had seen. I was the guest of Colonel Johnston, and it was the last time I saw that distinguished officer.

In the summer of 1891 I was placed on the Committee of the International Congress of Hygiene which was holding its triennial meeting in London. This gave me an opportunity of meeting many old friends from Vienna and other places, and I passed an exceedingly pleasant week. H.R.H. the Prince of Wales received the Congress at Marlborough House and in the evening there was a special entertainment at the Pavilion, which finished up later with a supper at the Café Royal. Greville and I took an M.P. home to his house, exhausted by the strain of the evening.

Every day clever papers were read on our subjects, and great interest was taken in all the work.

We had a splendid reception at Holly Lodge by the Baroness Burdett Coutts, but I regret that I can only recollect the peaches and a great figure in ambulance and military surgery, Sir William MacCormac.

On another evening we were entertained to a soirée at the South Kensington Museum. The week ended with a gala dinner at the Crystal Palace and fireworks afterwards.

The year was full of incident for me, and no sooner was one event over than another took its place. A week later the German Emperor visited England and was received by Her Majesty and also given the freedom of the City of London. On this occasion there was a parade of troops to line the streets, and the V.M.S.C. had to form first aid-posts at different points.

My duty was to ride from Buckingham Palace to the Guildhall, and it was very interesting to watch the crowds and see various little incidents among them. The Emperor had passed and was in the Guildhall at lunch, when I found myself talking to a Lancer officer. We also wanted lunch and determined to try a bluff. We rode straight up to the place and dismounting handed our horses to an orderly and walked straight in. We asked some functionary if His Majesty had gone in, and passed on till we

found an overflow place and got some lunch; we failed over drinks, but later soon made that good.

This was followed by a week at Aldershot, and parades there for the Emperor, as well as our annual training.

These annual trainings were very delightful, for we got in a lot of useful work. The V.M.S.C. was now reinforced by detachments from Aberdeen, Edinburgh, Manchester, Norwich and Maidstone.

We left Aldershot at the end of the training and I went on leave to Wales to stay with my oldest friend, Dr. Philip E. Hill, now Colonel (retired without pay) of the Welsh Division of the Territorial Army. Colonel Hill was one of the most painstaking efficient officers I have ever met.

I fractured my thigh. The first help I got was from Roberts, a bone-setter of repute. Then the St. John Ambulance Detachment carried me to Dr. Hill's, where I remained for many weeks. I was nursed and looked after by Colonel and Mrs. Hill, and I shall never forget their kindness to me.

Owing to my accident my programme with the re-editing of Sir Thomas Longmore's work had to be much delayed. I worked hard at it by the side of the Swanbourne Lake with my wife. She used to paint and I write in the calm and peace of that beautiful place. But my life in this Elysium was not to last. I was warned and soon after ordered to join at Netley.

On July 17, 1893, my eldest son Philip was born at Netley, and a month later we went on leave preparatory to returning to India for another tour of service. The recollection of my earlier tour was still fresh, though five years had elapsed since we left that pleasant land. It was the "East a'calling," as it always does those who have once been fascinated by its mystery and charm. I was fortunate in being permitted to exchange places on the roster with a brother officer, the result of which gave me some spare cash to clear up in England and start in India.

We were allotted passages in H.M.S. "Serapis," and I was in medical charge. The old Indian Troopers had been gradually disappearing, and H.M.S. "Serapis," the queen of all of them, was actually on her last trooping trip. It was the final setting of a very fine class of ship, and many regrets were expressed at their disappearance.

We left Portsmouth in September and reached Bombay a month later. The voyage was hot but uneventful, and on our arrival I was ordered to report at Deolali for duty. I had hoped to go up country, and was rather disappointed, but took no action and obeyed my orders.

(To be continued.)

Current Literature.

Butler, W. **Recent Methods of Sewage Treatment.** *Journal of the Royal Sanitary Institute*, April, 1931.

The author, associated with the chemist of the London County Council and the chemist in charge of the laboratories of the northern and southern outfalls of the L.C.C., has been studying the most suitable bio-chemical methods for the further treatment of London sewage. After investigating many methods it was found that two methods held the field, viz., air diffusion through tiles as installed at Manchester, and propulsion along channels as practised at Sheffield. Each had its place in the most satisfactory method for the treatment of sewage by humus suspended in intimate admixture with the liquid to be treated, but further modifications were desirable.

Two main conditions have been recognized as essential for the treatment of sewage by natural processes: (1) A plentiful supply of atmospheric oxygen throughout the volume of liquid to be treated, and (2) exposure under this condition to humus coating the aggregates, whether soil or filter beds. A great advance was made when Dr. Fowler dispensed with the aggregates and dispersed the humus—which became known as "activated sludge"—throughout the liquid into which air was directly diffused by pumping. The essential processes of purification are unchanged by this method, but it is possible to treat much larger quantities of sewage in any given limit of time and space.

When sewage from which gross suspended material has been removed by gravitation is mixed with suitable humus, in the form known as activated sludge, and the mixture is well shaken for a few minutes, the sewage becomes inoffensive and remains so indefinitely, whether exposed to the air or sealed up in a closed vessel and incubated at 80° F. for several days. The humus under suitable conditions seems to cause rapid oxidizing activity in the medium and precipitation of the unstable colloidal content—two essential aims in sewage purification. The humus is a living substance and is easily destroyed by chemical and physical agents. It can only function effectively when uniformly dispersed throughout the fluid and in the sustained presence of an excess of oxygen.

Butler and his co-workers found, after extensive trials, that there were two alternative applications of the principle of admixture of free humus with sewage and aeration of the mixture with atmospheric air :—

(1) Direct diffusion of air by blowing through tiles placed at the bottom of the tank ; and

(2) Exposure of ever-changing films of the mixture at the air-sewage interface by propulsion along channels under circumstances in which a maximum of such change was attempted.

The diffuser plant [1] was capable of dealing satisfactorily with a maximum of 56,000 gallons of whole sewage a day and with 80,000 gallons of sedimented sewage a day. The paddle plant [2] could deal with 80,000 gallons of whole sewage a day and 120,000 gallons of sedimented sewage a day.

A balancing tank was found to be necessary for the regeneration of humus, which had deteriorated through the accumulation of organic matter, and for this purpose a diffuser plant was found to be more satisfactory than a paddle plant.

When the humus was satisfactorily regenerated in a separate diffuser tank it was found possible to treat *satisfactorily* in the paddle plant mixtures of sedimented sewage and humus up to 300,000 gallons a day.

In order to economize the length of channel used in the paddle plant Mr. Tabor, the Assistant Engineer of the L.C.C., designed a double channel in which, at the end of a sixty-feet run, the sewage returned by a reverse flow beneath the floor of the upper channel and could be kept circulating as long as desired. The lower channel had a smaller diameter than the upper, and the velocity of the sewage in it was greater than in the upper channel. The direction of flow was reversed at each end of the channel, and the combined result was to cause great commingling of the liquid particles and the suspended humus.

The next improvement was the admission of air to the lower channel near the commencement of the return flow. By the provision of filets at either end a cushion of air continuously renewed was provided at the roof of the under column of fluid. The air was under greater pressure in the lower channel. Material improvement in efficiency was effected by the addition of air in the lower channel, and it was found possible to obtain stable inoffensive effluents by a residence of one hour in the channels.

On the large scale it was found impossible to extend the double channel as the liquid in the lower chamber would be in a dark inaccessible chamber, introducing unknown and adverse conditions. Butler found that this difficulty could be got over by "interrupting at desired intervals the septum separating the upper and lower channels and interposing in continuity with the ends of the interrupted septum what were virtually the blades of a propeller so arranged that the respective channels intercommunicated without disturbing the parallelism of the walls of the channels and with continuous separation of the channel contents."

The new channels were compared with the old, and when the supplemental air was used in each of the compared channels, the superiority of the new over the old was represented by an improvement of from twenty to fifty per cent in the quality of the effluent.

CRAIGIE, JAMES. **A Method of Drying Complement from the Frozen State.** *Brit. Journal of Exp. Path.*, 1931, xii, 75.

The complement, having been measured, is placed in a desiccator containing calcium chloride. The desiccator is then exhausted by means of a vacuum pump (Geryk) and the complement freezes solid. The desiccator tap is then closed. The complement is left till dry, usually overnight, when it can be removed; and it should then be stored *in vacuo* over calcium chloride at a low temperature. One pound of calcium chloride will dry seventy-five cubic centimetres of complement. For use, the dried complement is dissolved in distilled water to bring it proportionately to the original volume. The solution should be kept half an hour before being titrated.

The author claims the following advantages, amongst others, for his method:—

The complement, when reconstituted by the addition of distilled water to the dry substance, is indistinguishable in appearance and hæmolytic titre from the original.

It permits of the tests for the Wassermann reaction being carried out on many different dates with the same batch of complement.

The method may be applied to obtain dry stable preparations of other biological products and of certain infective agents.

CUMMING, H. S. **Prevention and Control of Venereal Diseases.** *Health News* (H-20), April 8, 1931. Issued by the United States Government.

Surgeon-General H. S. Cumming, of the Public Health Service, draws attention to the number of cases of venereal disease reported to the United States Public Health Service during 1930 by the State health authorities. There were 213,309 cases of syphilis and 155,875 cases of gonorrhœa. No single infectious disease had such a high incidence. All cases are not reported, and studies of prevalence of venereal disease in certain States show that the new infections in the year are probably 1,000,000.

The Public Health Service strives to improve the methods of treatment of the venereal diseases. Demonstration projects, financed from philanthropic sources, have shown what can be accomplished in the control of syphilis by simultaneous treatment of large numbers of syphilitic patients in a single locality at one time.

Great attention has been given to the prophylaxis and treatment of venereal diseases among American merchant seamen. Weekly talks are given by doctors to seamen patients in the Public Health Service hospitals. In these talks advice is given as to prophylaxis, and the dangers of neglect of treatment are pointed out. Prophylactic materials have been provided in many vessels and the Surgeon General acknowledges the great help received from the shipping industry in this matter.

Kline, B. S. **A Microscopic Slide Precipitation Test for the Diagnosis and Exclusion of Syphilis.** *British Journal of Venereal Diseases*, January, 1931, vii, 32.

In this modification of the flocculation reaction the test is performed on a microscopic glass slide, and in four minutes the result can be read under a low power of the microscope.

The author gives full descriptions of the methods of preparing the antigens used; they are essentially ethyl alcohol extracts of dried beef heart to which an alcoholic solution of cholesterin is added. The making of these extracts is a complicated business, but they could be prepared in a central laboratory and issued for geueral use. There are slight modifications in the amounts of the various constituents of the antigen, according to whether the test is to be performed on serum, heated or unheated, or on laked blood obtained from a finger prick, or on cerebrospinal fluid. The author further modifies the antigens according to whether he is examining an individual to exclude the possibility of his being syphilitic—for example, in a blood donor—or whether he is examining a suspected syphilitic or a patient undergoing anti-syphilitic treatment. Both types of test can be done at the same time.

The simplest test is that carried out on a serum heated at 56° C. for thirty minutes. Twelve paraffin wax rings, each of fourteen millimetres diameter, are prepared on a glass slide according to a method described in the paper. This allows of six sera being tested, each with a "diagnostic test" antigen and with an "exclusion test" antigen. 0·05 cubic centimetre of a patient's serum is placed in each of the rings and 0·008 cubic centimetre of the appropriate antigen emulsion is then added. The slides are rotated on the table for four minutes, at the end of which time the result can be read.

A negative result shows no change in the serum-antigen mixture; in a strong positive large clumps are seen with clear areas between, while in lesser degrees of positive reaction, smaller clumps or even fine granules form.

This test is extremely easy to perform, and the author claims that it is rather more sensitive than the Wassermann reaction, and that it is not less specific than the latter.

Reviews.

INTERNATIONAL HEALTH YEAR BOOK, 1929. Allen and Unwin, Ltd. Price 24s.; cloth 32s.

The Health Section of the League of Nations has published its International Health Year Book for 1929.

This is the fifth volume of this publication, and it contains information concerning forty countries: Australia, Austria, Belgium, Canada, Czecho-Slovakia, Denmark, Dominican Republic, Egypt, Estonia, Finland, France, French Colonies, Germany, Greece, Hungary, Irish Free State, Italy, Japan, Latvia, Lithuania, the Netherlands, Norway, Poland, Portuguese India, Roumania, Spain, Sweden, Switzerland, Turkey, the United Kingdom (England and Wales, Scotland, Northern Ireland), Ceylon, Federated Malay States, Straits Settlements, British Somaliland, Union of Soviet Socialist Republics, the United States of North America, the Philippines, Uruguay.

The object of the Year Book is to give a survey of the progress made by the various countries in the domain of public health. It indicates new developments in the working of the various health services, gives the most recent data as regards vital and health statistics, and reviews the work of the principal international organizations dealing with public health, such as the League of Red Cross Societies, the Rockefeller Foundation and the League Health Organization.

The information contained in the Year Book is furnished by the heads of national health services or persons deputed by them for this purpose.

The statistics and data concerning each of the forty countries are arranged on the uniform lines adopted by the League Health Organization and include twenty-seven standard tables. These tables are designed to present the minimum of vital statistics necessary to allow the reader to interpret correctly the information relating to health conditions in any given country and to compare the health conditions of the various countries.

The twenty-seven tables fall into the seven following groups:—

(1) *General Demography* (4 tables).—Area and population according to the results of the last two censuses; density of population and excess of one sex over the other, according to the results of the last two censuses; distribution of the population by age and sex, according to the results of the last census and estimate of this distribution for 192... (last estimate); survey of the movement of the population, 1922 to 1928.

(2) *Birth-Rates* (5 tables).—Geographical distribution of births in 1927 and 1928; number of births according to sex and vitality, 1922 to 1928; births and abortions in certain districts; legitimacy and illegitimacy of births for the years 1922 to 1928; monthly number of live-births, legitimate and illegitimate, in 1926, 1927 and 1928.

(3) *General Death-Rate* (4 tables).—Geographical distribution of general death-rate in 1927 and 1928; death-rate according to sex for the years 1922 to 1928: death-rate according to age and sex, 1926 and 1927; seasonal distribution of deaths in 1927 and 1928.

(4) *Causes of Deaths* (6 tables).—Mortality, incidence and case fatality of certain infectious diseases in 1927 and 1928; death-rate from tuberculosis according to age and sex in 1927; death-rate from tumours, 1926 to 1928; deaths from puerperal diseases for the years 1926 to 1928; deaths from external causes and general death-rate from natural causes from 1926 to 1928.

(5) *Infant Mortality* (3 tables).—Infant mortality according to days and months of age, sex and legitimacy from 1926 to 1928; seasonal variations in the death-rate of legitimate and illegitimate children under 1 year of age in 1926 and 1927; mortality according to causes of death in 1926 and 1927.

(6) *Public Health Statistics* (2 tables).—Institutions for the campaign against social diseases; institutions for the protection of mothers and children in 1926, 1927 and 1928.

(7) *Data on Curative Medicine* (3 tables).—Statistics of hospitals, &c., in 1926, 1927 and 1928; statistics of sanitary personnel in 1926, 1927 and 1928; statistics of health insurance funds in 1926, 1927 and 1928.

The Year Book also contains a survey of industrial hygiene in Germany, Belgium, Great Britain, Italy and the Netherlands.

HINTS ON EQUIPMENT AND HEALTH FOR INTENDING RESIDENTS IN THE TROPICS. (Second Edition). By J. Balfour Kirk, M.B. London: Baillière, Tindall and Cox. 1931. Pp. xii + 128. Price 3s. 6d. net.

Hints on "Equipment and Health in the Tropics" by J. Balfour Kirk, M.B., distinctly appeal to me. The method of presentation in the form of letters to a young couple who intend to reside abroad makes for easy and interesting reading. The advice given is very sound and obviously the result of personal experience. Every word bears the mark of residence in the East and of an extensive experience of its "little ways."

The instructions as to the care of children are clear and well founded. The book is neat, well printed and got up and handy for carriage. In short, a volume which should be in the possession of every prospective resident in the Tropics whether married or single.

N. L.

INDIVIDUAL DIAGNOSIS. By F. G. Crookshank, M.D., F.R.C.P. (Psyche Miniature Medical Series). London: Kegan Paul, Trench, Trübner and Co., Ltd. 1930. Pp. 89. Price 2s. 6d. net.

In this little book, Dr. Crookshank gives us two papers which are based on two of his lectures: the one given before the Cambridge University Medical Society and called "Diagnosis and the Syndrome," the other

delivered before the Society for the Study of Individual Psychology and termed "Organ-Jargon."

The theme of his first lecture is of great interest and its meaning should be taken to heart by every medical man. What is diagnosis? Surely, says the author, it is the thorough understanding of things present, and diagnosis in terms of diseases is but the adoption of one diagnostic convention and that not necessarily the best. This may not please the man who likes to have his medical knowledge arranged and labelled in neat pigeon holes, but Dr. Crookshank's reasoning carries conviction with it. In telling us about psychology the author is very entertaining—the story of the gallant admiral with herpes for instance, and that of the little boy at his Christmas dinner are excellent, but it is by drolleries such as these that he leads us on to see what is at the back of it all and how in "experience" we have to deal with correlations between "organ states" and "emotion states," correlations which are sometimes simple and sometimes very complex. A. C. H. G.

General Practice (Some Further Experiences). By Ernest Ward, M.D., F.R.C.S. London: John Bale, Sons and Danielsson, Ltd. 1930. Pp. 108. Price 3s. 6d.

In a sequel to his original book, Dr. Ward gives us some more of his interesting and instructive experiences gained during a long career in general practice.

This little book, once begun, is one which few readers will put down before they have finished it. We could wish for more books such as this to enliven general medical literature, for it contains a wealth of common sense presented in an attractive form.

Diet and Care of the Surgical Case. By R. H. Boyd, M.B., etc. London: H. K. Lewis and Co., Ltd. 1930. Pp. x + 106. Cr. 8vo. Price 5s. net.

The author has collected from various sources a number of established lines of treatment of surgical cases in the way of pre- and post-operative treatment.

After preliminary chapters on general dietetic measures, preparation and after-care of operation cases, the remaining chapters of Part I deal with operations on the various regions of the body. Part II deals with preparation and after-care of operations in childhood—and the Appendix gives details of recipes, enemata, lotions, etc.

A great deal of extremely valuable information is provided, especially on the line of dietetics and post-operative feeding. The volume is small, easily read, and contains a number of useful measures not to be found in the standard textbooks. J. M. W.

THE CATECHISM SERIES. PATHOLOGY. Third Edition. Part V. Edinburgh: E. and S. Livingstone. Pp. 79. Price 1s. 6d. net.

These excellent "Manuals" do serve a really useful purpose. They are not primarily intended for teaching a subject to the beginner: their function is to train a candidate to answer examination questions concisely and at the same time to revise his knowledge of the subject.

In the section under review the questions are of the type usually set in the final qualifying examinations in pathology and the answers are given in an orthodox fashion.

The descriptions of the morbid anatomy of the various conditions are well written and extremely clear. The section on nephritis might with some advantage have been brought into line with modern teaching. Also, it is doubtful if the old diagrams from Green's "Manual" have any real value in a book of this nature.

Notice.

"BAROLAC."

MESSRS. BURROUGHS WELLCOME AND CO. now supply a brand of barium sulphate, put up in a 30 per cent suspension, known as Barolac, specially prepared for X-ray work. They state that it is entirely free from soluble barium salts and that it is tasteless, odourless and neutral. The salt is so finely divided that no suspending agent is required and flavouring agents are unnecessary.

INDEX TO VOLUME LVI.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

Journal

of the

Royal Army Medical Corps

Journal

OF THE

Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTED BY

LIEUTENANT-COLONEL A. DAWSON, R.A.M.C.

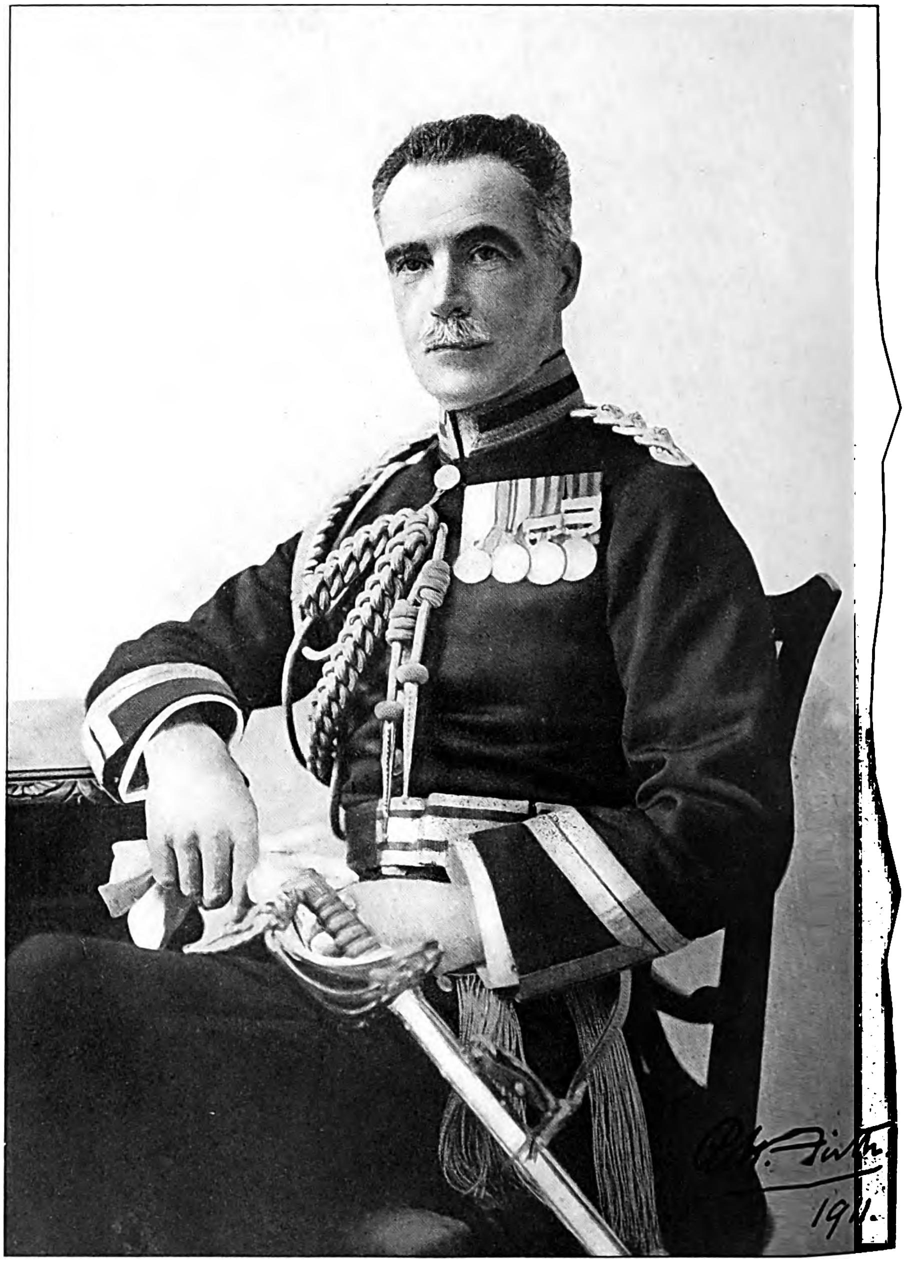
MANAGER:

MAJOR S. W. KYLE, R.A.M.C.

VOL. LVII.

July—December, 1931.

JOHN BALE, SONS & DANIELSSON, LTD.
83-91. GREAT TITCHFIELD STREET, OXFORD STREET, W. 1.



Colonel Sir ROBERT H. FIRTH,

K.B.E., C.B.

First Editor of the Journal of the Royal Army Medical Corps.

Vol. LVII. July. 1931. No. 1.

Authors are alone responsible for the statements made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Obituary.

SIR ROBERT HAMMILL FIRTH, K.B.E., C.B.

The news of the death of Sir Robert Firth will be received with great regret by many officers of the Corps, and especially by those who worked with him at Netley, Aldershot and in London.

Firth had an outstanding personality and devoted all the powers of an unusually acute brain to improving the conditions of the British soldier's life. Perhaps his devotion to scientific work may be partly attributed to his association at University College, London, with a brilliant band of students who in later life attained world-wide fame. Firth used often to talk about Halliburton, later Professor of Physiology at King's College; Victor Horsley, the eminent surgeon who died on service in Mesopotamia; and Dawson, who edited the *British Medical Journal* for so many years. In his quaint way he would say the size of the head is no indication of the mental powers, for Horsley had the smallest head but the acutest brain in the college. He seemed to be quite unaware that he himself was another illustration of his argument, for though his head was small his mental powers were of a very high order.

Firth combined great accuracy of statement with an outstanding capacity for putting hard scientific facts in simple, graceful language. He was a born writer, and apart from his scientific papers he made many contributions on philosophic subjects to well-known magazines as well as to the Journal of the Royal Army Medical Corps.

Firth obtained the F.R.C.S.Eng. in 1882 and joined the Army Medical Department as a surgeon on August 3, 1883. Quite early in his Army

career he turned his attention to hygiene and gained the Parkes Memorial Prize and Medal in 1889 and again in 1892.

His first tour of foreign service was in India and he served with the Hazara Expedition, for which he received the Frontier Medal and clasp.

In 1892 he was appointed Assistant Professor of Hygiene at the Army Medical School, Netley, and held this post for five years. Colonel J. Lane Notter was the Professor of Hygiene and in 1896, in conjunction with Firth, now a Surgeon-Major, published the well-known "Theory and Practice of Hygiene." Parkes' "Practical Hygiene" had been the standard text-book for many years and the work had passed through many editions, the last being brought out by Professor de Chaumont just before his death in 1888. But by the year 1896 so much new matter required to be incorporated in the work, that Colonel Notter and Major Firth felt the individual character of Parkes' book would be ruined if they attempted to revise it in accordance with the requirements of the time. They accordingly decided to write a new book for which they alone would have responsibility. The popularity of the "Theory and Practice of Hygiene" proved that they were right in their decision. The book passed through three editions, the last being almost completely rewritten by Firth in 1908. This edition was a large volume of nearly 1,000 pages, and the labour entailed in its compilation must have been enormous.

On completion of his appointment at the Army Medical School, Firth again proceeded to India and took part in the Operations on the North-west Frontier in 1897-98.

In the eighties and nineties enteric fever became very prevalent among British troops in India. In 1895 there were 1,544 admissions and 343 deaths from enteric fever; in 1898 the admissions were 2,375 and the deaths 654. Alarmed by this gradual increase of disease, the Government of India sanctioned the appointment of three specially qualified officers with headquarters at Rawalpindi, Umballa and Lucknow, whose sole duty would be to investigate fully the causes of disease and give practical advice in sanitary matters. Major R. H. Firth was appointed to the Rawalpindi District in 1898. No bacteriological apparatus was available and when it arrived there was no place to put it in. Firth wrote: "The work I have had to do has been entirely personal work. The only help sanctioned is a chuprassi, an unskilled man of all work, who helps to clean up. All my culture media have to be made by me personally."

A year later he wrote, "The heat of my laboratory at Lucknow is so intense, that during the hot weather I had to start work at 4.30 a.m. and even then the temperature was over 90° F. In addition to this one had to bear the vexation of cultures and media continually getting contaminated owing to dust and dirt blowing through badly-fitting windows and doors." In spite of these appalling conditions Firth managed to carry out some valuable research work on dysentery bacilli, which he afterwards incorporated in a paper published in the Journal of the Royal Army Medical Corps, 1903.

On the retirement of Professor Lane Notter in 1900, Major Firth was appointed Professor of Hygiene in the Army Medical School, Netley. His opposite number in Pathology at that time was Professor A. E. Wright, who had as his assistants Major Semple and then Major Leishman. With so many active minds at work preventive medicine took on a new lease of life, and much valuable research work was done under the supervision and with the active assistance of the two professors. At that time the prevention of enteric fever was constantly in the thoughts of the laboratory workers, and while Wright and his assistants laboured at anti-typhoid inoculation Major Firth and the Assistant Professor of Hygiene, Major Horrocks, worked on the saprophytic existence of the *B. typhosus*, and the results of their investigations were embodied in a paper on "The Influence of Soil, Fabrics and Flies in the Dissemination of Enteric Infection," which Major Firth read at the Annual Meeting of the British Medical Association in 1902.

When the Army Medical School was brought to London, Firth carried on his research work with some difficulty in the laboratories on the top of the building owned by the Royal College of Physicians on the Embankment close to Waterloo Bridge.

In 1903, when Sir William Taylor was Director-General, it was decided to publish an R.A.M.C. Journal under the direction of a Library and Journal Committee. Major Firth had the proud distinction of being selected to be the first editor. He arranged the lines on which the Journal should appear, and contributed to the first volume an article on "A Comparative Study of some Dysentery Bacilli."

In 1906 Firth was appointed Instructor at the School of Army Sanitation which had just been established at Aldershot. Here he had a larger sphere of work, as he was brought in contact with Generals and Officers Commanding Regiments, who a few years later held high commands in the Expeditionary Force. Firth's enthusiasm for his work proved very infectious and roused in Senior Army Officers, many of whom were imbued with the views contained in Lord Wolseley's "Soldier's Pocket-Book," a sense of the importance of sanitation in the field. There is little doubt that Firth's work at Aldershot laid the foundations of the sanitary effort which helped to preserve so many lives in the Great War.

On the expiration of his appointment at Aldershot, Firth again proceeded to India. In 1902, the appointment of a Sanitary Officer at Army Headquarters had been approved. Major McGill filled the post for a time and was succeeded by Firth, now a Colonel. On December 1, 1912, as part of an economy campaign, the appointment of A.D.M.S. (Sanitary) at headquarters was abolished, and Colonel Firth was the last holder. The post was re-established in 1916, but by that time Firth had left for France. In March, 1915, he was appointed A.D.M.S. of the 20th Division, and in September, 1915, was appointed to be D.D.M.S. of the 11th Corps. He held this appointment until May, 1917, when he was transferred to the Havre Base.

Colonel Firth was mentioned three times in Despatches, and for his services in France received the Victory and Allied Medals, and the C.B. Military in 1917. In June, 1919, he was made a Knight Commander of the Order of the British Empire (K.B.E.).

In 1919 Colonel Firth and several of his officers received a silver medal from the Municipality of Havre, in recognition of medical services rendered to the civilian population of the town.

In 1924 he received a Good Service Reward, which he had well earned by his most useful work for the State.

After his retirement from the Army, Sir Robert Firth still maintained his interest in the Corps, and wrote many articles for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. The most notable among his contributions were the "Musings of an Idle Man," which he afterwards published in book form.

Sir Robert took a keen interest in the Army Medical Officers' Widows and Orphans Fund, of which he had been President for four years at the time of his death. He devoted much time and thought to its affairs, and was always devising schemes for its advantage. He did not allow his painful illness to interfere with his schemes, and attended meetings in connection with the Fund when work was obviously beyond his strength. He was especially interested in the result of the recent valuation, and, hearing that the actuary's report thereon had been received, insisted on the whole of it being read to him in one of his last intervals of consciousness.

Sir Robert Firth was a Fellow and Member of Council of the Royal Sanitary Institute, a Fellow and Member of Council of the Royal Institute of Public Health, a Fellow of the Society of Medical Officers of Health, and a Membre de la Société de Médecine Militaire.

Original Communications.

AMPUTATIONS AND STUMPS.

By Major J. M. WEDDELL.
Royal Army Medical Corps.

The following notes have no pretention to originality. They attempt to collect the present consensus of opinion on the subject of amputations, and will be found to differ rather considerably from the standard textbook teaching. Many points have been derived from experience at the Queen Mary's Hospital for Limbless Men at Roehampton.

I am much indebted to Major R. D. Kelham, M.D., of that Hospital, for his very helpful suggestions.

The staff of Queen Mary's Hospital have been dealing with amputations and limb fitting from the Great War up to the present time, and must have an almost unique experience in this work. They are therefore in a position to give authoritative views on the types of amputations that survive the test of time, and on all the very specialized points in regard to the fitting of artificial limbs.

Essential Features of a Good Stump.

(1) *The stump must be of suitable length for fitting an artificial limb.* It should provide a lever of sufficient length and power for the attachment and use of an artificial limb at the level of amputation.

For *above knee* amputations the *length* of the functioning stump for limb-fitting purposes should be taken from the perineum. For *below knee* amputations, the limit of useful length is that amount of stump which can be retained in the below-knee socket when the knee is flexed at ninety degrees.

The usefulness of a short stump is in inverse ratio to the amount of redundant tissue present, i.e., a short, poorly covered stump is of greater functioning value than a fleshy stump of the same length, other things being equal.

(2) *The end of the stump should be covered with skin and subcutaneous tissue only.* The skin must be healthy and well-nourished, and there should be no hyperæsthetic or anæsthetic areas. Both skin and scar should be freely movable over the deeper structures.

(3) *The scar should be linear, non-adherent, and placed so that there is neither pressure nor traction on it.*

(4) *The skin over the stump should be slack but not redundant.* In this particular respect the success or failure to produce a satisfactory stump

will be influenced largely by the nature of the post-operative or convalescent treatment.

(5) *There should be no disease of bone.* Radiograms should be taken in two places at right angles to each other.

If bone disease is present, sinus formation will occur, with resulting adherence of scar, etc.

(6) *There should be full range of movement in the proximal joint.* Though full range of movement of the joint is desired and can be secured (if the joint is normal), provided post-operative treatment is correct, a limitation of movement at the hip or knee does not preclude limb-fitting or limb-wearing, provided the degree of flexion is not too great, and that in above-knee cases the stump is short.

Methods of Amputating.

(1) *Circular.* Dissect up skin and fasciæ. Pull up the muscles and divide in layers so as to form a cone with the bone at the apex.

(2) *Modified circular,* i.e., circular with short side cuts, which really equal flaps.

(3) *Elliptical.*

(4) *Racket.*

(5) *Flaps.* (Equal, unequal—antero-posterior, lateral, etc.). Generally speaking, the shorter the flaps the better their nutrition; avoid long flaps.

The base of each flap should be equal to one-half of the circumference of the limb at the point of bone section.

One and a half times the diameter of limb is usually advised for the combined length of flaps. This is too long and the combined length should be not more than the diameter of the limb at the level of bone section.

Method of Cutting Flaps.

Flaps should be cut from without inwards. Skin and subcutaneous tissue only must be taken, except just at the base where a small amount of muscle may be included.

If any doubt exists as to the length of the flaps, these may be cut longer than necessary, as they can be shortened after the bone is divided, whereas if they are cut too short in the first instance, the bone will have to be redivided and the resulting stump will be shorter than was originally intended.

The old *transfixion* method is now obsolete; long knives are necessary, muscle is retained in the flap, and vessels and nerves may be lacerated.

The *guillotine* amputation, as performed at times in the Great War, was extremely wasteful, as the skin always retracted and a secondary *high* amputation was necessary. If this form of amputation is called for, always cut flaps of some kind and evert them. At the earliest possible moment

bring these flaps down by skin extension, remembering that permanent skin stretching occurs in six weeks.

Treatment of Structures in the Flaps.

(1) *Bone.*

Commence the saw-cut by steadying the saw against the thumb of the left hand, and with a few light strokes from heel to apex of the saw cut a groove. The assistant must hold the limb steady—avoiding locking the saw-blade by upward pressure and splintering of deep part of bone by downward pressure on the limb.

Round off and cut away any spikes with bone forceps. Bevel off protuberant edges, e.g., crest of tibia.

(2) *Periosteum.*

- (*a*) *Aperiosteal.* Divide periosteum with a knife half an inch *above* the level of bone-section and scrape the periosteum off the bone down to the level of the bone-section. The bone denuded of periosteum is then sawn through. This is said to leave the end of the bone hard and sclerosed and to avoid spur formation.
- (*b*) *Periosteal Cuff.* Divide the periosteum half an inch distal to the proposed line of bone-section, then turn up a cuff of periosteum and, after sawing the bone, sew the periosteum over the cut surface.
- (*c*) *Osteo-periosteal* operation, e.g., Pirogoff's and Stokes-Gritti's are not recommended.

Use an amputation shield or bandage retractor when sawing, to avoid bone dust flying on to cut muscle, etc.

Whatever method of treating the periosteum is adopted, it has been found that in above-knee stumps spurs seem fated to appear later, but unless they become adherent to overlying scars they produce no symptoms and do not interfere with limb-fitting, and a re-amputation has rarely to be performed for this reason alone.

(3) *Muscle.*

Consensus of opinion is that there should be no muscle in the flaps. A bulky flap is bad for fitting the prosthesis; also the muscle, if retained, turns into fibrous tissue which is often painful. A little deep muscle at the base of the flaps to ensure their nutrition is all that is required.

Nerves.

Bulb formation at the end of a divided nerve is the natural way of sealing the nerve trunk, and therefore must be expected with every divided nerve. The bulbs may be large, but so long as they are not *inflamed*, *adherent* to other structures such as skin, muscle, etc., or in a position where they are subjected to pressure by scar tissue, or by the artificial limb, they will usually give no trouble.

End bulbs of small cutaneous nerves, such as the communicans fibularis

in the leg and the internal saphenous in the thigh, are the most likely to be troublesome, as they are small and thus, being usually overlooked at the time of operation, become included in the scar.

Crush and cut all recognizable nerves about one inch above the level of bone-section, then inject absolute alcohol into the nerve-trunk above the cut end to block any painful impulses from the operation area.

Opinions differ as to the value of ligature of the divided trunk. Against this is the fact that ligature without alcohol injection is bound to cause pain, and a ligature is a foreign structure which may cause trouble. Pulling down large nerves and dividing them high up is not satisfactory (severe post-operative pain and traumatic neuritis).

Conditions in which the bulb nerves may become painful and troublesome :—

(1) When there has been long-standing infection prior to amputation.

(2) Excessive addiction to alcohol.

(3) Too early pylon- or limb-fitting, coupled with too early manipulative treatment of the stump after operation.

Drainage.

This is advisable in all limb amputations for twenty-four to forty-eight hours, as it prevents hæmatoma formation, in which a low grade infection often occurs. Wilson (U.S.A.) and P. J. Verrall advocate no drainage.

After treatment.

(1) *Immediate.*

Apply a firm bandage and Gooch splinting, especially in above-knee and below-knee amputations ; this steadies the limb and avoids painful muscle spasm. Also steady the stump with a light sand-bag *above* it.

Keep all leg amputations in bed for three weeks. Nurse the patient with the stump in the normal position, i.e., avoid flexion contractures.

(2) *Later.*

Massage and Movements.—Active joint movements by the patient are better than passive joint movements.

There should be no general massage to the stump for some time after the amputation, to allow the nerves to settle down. The less painful the convalescence the less likelihood there is of subsequent neuralgia from bulbs, which frequently occurs in cases where external irritation is permitted.

If massage is given at all, it should be limited to the purpose of keeping the scar tissue from becoming adherent—and probably active movement by the patient will be sufficient for this purpose.

Shrinking of Stumps.—The average time for shrinking is three months. Assist this by keeping a firm bandage on the stump. The scar should be rubbed with spirit every night when the bandage is taken off. A new socket for the permanent limb will be required within six months in primary amputations on account of shrinkage.

Pylons.—These are said to teach patients to walk earlier and to assist in shrinking of the stump (which they undoubtedly do), especially in above-knee amputations.

They teach balance but are of little value in teaching orientation. They induce a bad gait which has to be unlearned when the permanent limb is fitted.

In certain types of above-knee stumps, pylons are of some value in reducing them and shaping them up.

They are not good for below-knee stumps.

The full function of a stump depends on its normal position during convalescence and the maintenance of its musculature in good condition.

Amputations of the Lower Extremity.

There are three types for consideration: (1) Syme; (2) below-knee; (3) above-knee.

Generally speaking, in (2) and (3) the scar should be posterior, and two to three inches above the end of the stump.

(1) *Syme's Amputation.*

There is an end-bearing stump and the patient can walk on the stump without wearing the limb (in the house). It is an excellent amputation provided the stump *remains* in good condition.

It must be entirely condemned in infected cases. *Roughly six to ten years seems to be the life of a Syme, and after that re-amputation is usually necessary*:

Because (i) the end pad in many cases does not retain its position and gets forced laterally.

(ii) The stump is more liable to circulatory troubles than any other long stump, becoming blue, cold and painful.

(iii) The stump is liable to neuromata, very often pin-head in size, but very painful.

(iv) The scar is frequently keloidal and painful; the piston action of stump in the socket aggravates this.

(v) The formation of callosities is practically certain sooner or later; they often ulcerate, and even if this does not occur they become very tender, simulating soft corns.

(vi) The scar being anterior and transverse is liable to be dragged on and often ulceration results.

Certainly the number of Syme's is gradually diminishing, and when patients have been fitted with the below-knee limb they are very thankful for the change.

(2) *Below-knee Amputation.*

The present site of election is distal to the line of the knee-joint, so as to leave six or seven inches of tibia.

(The old site of election, just below the tubercle of tibia, gives a short stump for the fitting of a peg-leg.)

Control of the knee can be obtained with as little as three to four inches of the tibia.

If the stump is longer than seven inches the skin is poorly nourished; ulceration and eczema are almost certain to result.

The general opinion is that the fibula should be divided one inch above the tibia. In short stumps the head of the fibula may be taken away altogether. If this is done the normal period of convalescence prior to limb wearing should be increased to give time for the site to settle down to take weight on the new surface.

Methods.

(i) Long anterior and short posterior flaps, bringing the scar on the posterior surface and well above the end of the stump.
(ii) Postero-external flap.
(iii) Equal lateral flaps; these should be avoided, the scar gets drawn up between the tibia and fibula.
(iv) Posterior flap.

Splinting of the knee is very important.

Do not amputate in the lower third of the leg; the flaps will be poorly nourished and unsatisfactory (e.g., Teale).

(3) *Above-knee Amputations.*

Amputations around the knee, e.g., Stephen Smith, Carden-Gritti and Stokes-Gritti, are unsatisfactory.

Taking the length of an average femur to be nineteen inches, the site of election should be four to six inches above the adductor tubercle for level of bone-section.

A stump longer than ten to twelve inches from the trochanter is very liable to circulatory trouble and usually comes to re-amputation.

A long stump, i.e., longer than ten to twelve inches, often fouls the knee-control mechanism. End-bearing thigh stumps give trouble sooner or later.

Few stumps nowadays are end-bearing at all.

(4) *Hip Amputations.*

An amputation may be performed at any point from just below the great trochanter up to the joint itself.

After amputations the patients are fitted with a tilting-table apparatus (tuber-bearing). The muscles must be cut short and the following methods have been employed :—

(i) Anterior racket.

(ii) Gluteal flap (leave sciatic nerve bulb unshortened—if shortened, patient sits on the bulb).

(iii) Furneaux-Jordan : this type is obsolete.

Total excision of the head of the femur is not popular since when it can be retained the head of the femur and the great trochanter form a good

anchor on which to fit the socket and tend to give shape to the stump, thereby aiding fitting. An amputation at the level of the lesser trochanter gives a very suitable stump for the fitting of a tilting-table leg.

The average length of a stump (from the tip of the great trochanter) which has to be fitted with a tilting-table leg is $4\frac{3}{4}$ inches; the longest stump fitted with such a limb is 6 inches. If the stump is more than this, a very bulky and cumbersome socket has to be made, adding weight and causing discomfort to the patient.

When from the surgical or mental point of view an above-knee stump is of such a nature that it is functionally useless for fitting an ordinary above-knee limb, a re-amputation for the purpose of shortening the femur is necessary to enable a tilting-table leg to be fitted.

The Upper Extremity.

Hand.

Conservative surgery is essential. It must be remembered that a digit acts in two ways : (i) As a sense organ ; (ii) as a mechanical contrivance.

(1) There can be no comparison between the value of a mechanical contrivance such as a hook, split pin, etc., which is at best a clumsy contrivance to aid in holding and carrying, and a finger or portion of finger with the skin and nerve supply intact. As stated above this is a sense organ and, as such, cannot be replaced by any artificial means.

(2) The thumb owing to its free mobility is worth half the hand, and as much as possible should invariably be saved.

Removal of the head of a metacarpal bone weakens the hand very greatly. It should be conserved for working hands. It can be removed for æsthetic effect.

Farabœuf's flaps are recommended for the index and little fingers, as they avoid pressure on the scar.

Forearm.

The scar should be terminal, *not* on the flexor or extensor aspect, as this would cause friction against the prosthesis; the flaps should be equal, anterior and posterior or lateral.

The site of election should be not less than six inches and not more than seven inches from the tip of the olecranon. Disarticulation through the wrist-joint and long forearm stumps are unsatisfactory. If any portion of the forearm can be retained, this should be done. Even two inches of forearm if properly fitted with a limb gives a surprising amount of power and utility.

Amputation through the Arm.

The site of election is seven to eight inches from the tip of the acromion, or at least two inches above the epicondyle—with equal anterior and posterior flaps, producing a transverse terminal scar.

Through-elbow type of amputation is unsatisfactory (*a*) for surgical, and (*b*) for mechanical reasons.

(*a*) Surgical: Adherent scar tissue, malnutrition of skin, and presence of bony prominences.

(*b*) Mechanical: An awkward, unsightly and ill-fitting prosthesis predisposes the stump to inflammatory processes and impaired muscularity, and frequently necessitates a re-amputation.

If the neck of the humerus is intact, amputations through the shoulder are much more easily fitted with a limb than disarticulations at the shoulder-joint. With disarticulation through the shoulder-joint by anterior racket operation it is difficult to fit the stump with a prosthesis, but some results have been very good. Scar should be vertical in the middle of the subacromial cavity; axillary nerves should be free from pain; and the chest wall, where shoulder cap presses, should be free from any condition likely to cause excoriation.

Forequarter amputation is very rarely done. The inner end of clavicle should be removed and the subclavian vessels tied; this gives more room and there are no tributaries to the subclavian vein here. Injection of the brachial plexus with novocain diminishes shock.

Lastly, the mentality of the patient must be borne in mind.

However surgically good a stump may be, it is often rendered useless by the poor mentality of the patient, and this must be taken into consideration by the surgeon when amputating or re-amputating with a view to the subsequent fitting of a prosthesis.

THE SLIDE-RULE AND AGGLUTINATION.

By Major R. F. BRIDGES.
Royal Army Medical Corps.

The full technique of Dreyer's agglutination test involves the expression of results in so-called "standard agglutinin units," or, according to the latest nomenclature, in "reduced titre." In order to find the reduced titre of a serum it is necessary in the first place to calculate the dilution in which standard agglutination occurs. This is carried out with the help of Dreyer's reduction table, the dilution value of the end-tube of the reaction being multiplied by a factor appropriate to the observed degree of agglutination seen in that tube. Having determined in this manner the point of standard agglutination, the reduced titre of the serum is calculated by dividing the value so obtained by the suspension factor of the particular emulsion against which the serum has been tested.

It is evident, therefore, that in every test two sums, in multiplication and division, are necessary before the result of the test can be recorded. While these sums are simple enough in themselves, it will be agreed by every busy pathologist that they become extremely onerous when many tests are being done, and a mistake in the figures themselves or a shifting of the decimal point is an accident likely to occur.

With a view to surmounting these difficulties a slide-rule was devised which has been found very useful in practice. It carries out both calculations by a single movement of the slide, and gives results which are more accurate than those which may be expected from the agglutination test itself. It is constructed of such simple materials as wood planks, cardboard and seccotine, with the help of a 5H pencil, a fine pointed pen-nib and a wooden ruler. Additional requirements are a book of logarithms and a steady hand.

The principle of a slide-rule is a very simple matter. It will be remembered from one's schooldays that, when it was required to multiply two numbers together by logarithms, the two numbers were turned up in a book and the logarithm of the one number *added* to the logarithm of the other. The sum of the two logarithms was the logarithm of the two numbers multiplied together. Similarly, division was carried out by *subtracting* the logarithm of one number from the logarithm of the other. Now the slide-rule is an adaptation of this principle, but whereas in the book the logarithms are stated as numbers, on the slide-rule they are shown as distances from the starting point of the scale. When the distance representing the logarithm of one number is added to that representing the logarithm of the other the sum of the two is the length representing the logarithm of the two numbers multiplied together.

To illustrate this idea by a concrete example: The logarithm of 2 is

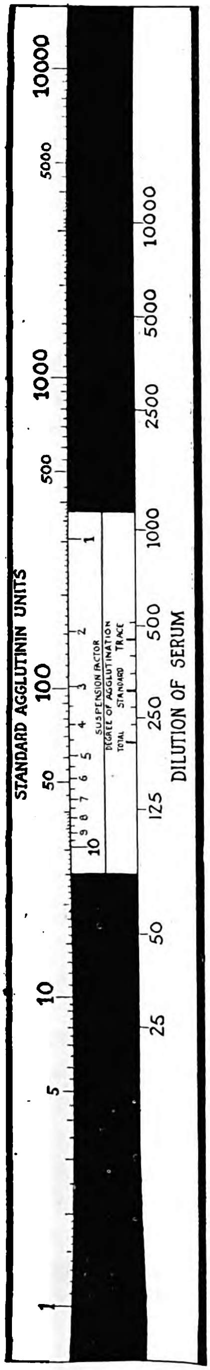
0·301 and a few more figures besides; the logarithm of 3 is 0·477, also with as many more figures as desired. Adding these two logarithms together we obtain the figure 0·778. Now if a scale be constructed and the figure 2 be placed at 3·01 inches from the starting point and the figure 3 at 4·77 inches, adding these distances together we obtain a length of 7·78 inches, which gives us the position of the figure 6; for the logarithm of 6 is 0·778. When using a slide-rule, therefore, 2 is multiplied by 3 by adding a length representing the logarithm of 3 to that representing the logarithm of 2. In the same manner the positions of all other numbers on the scale are fixed by their logarithms. The figure 1 will always be placed at the starting point of the scale, for the logarithm of 1 is 0.

Now common logarithms are said to be "constructed to the base 10," which in other words means that the logarithm of 10 is 1. On the slide-rule, therefore, the distance between the figures 1 and 10 may be described as the "base-length." The logarithms of the numbers 100, 1,000 and 10,000 being 2, 3 and 4 respectively, these figures are placed at distances from the starting point equivalent to twice, three times and four times the base-length.

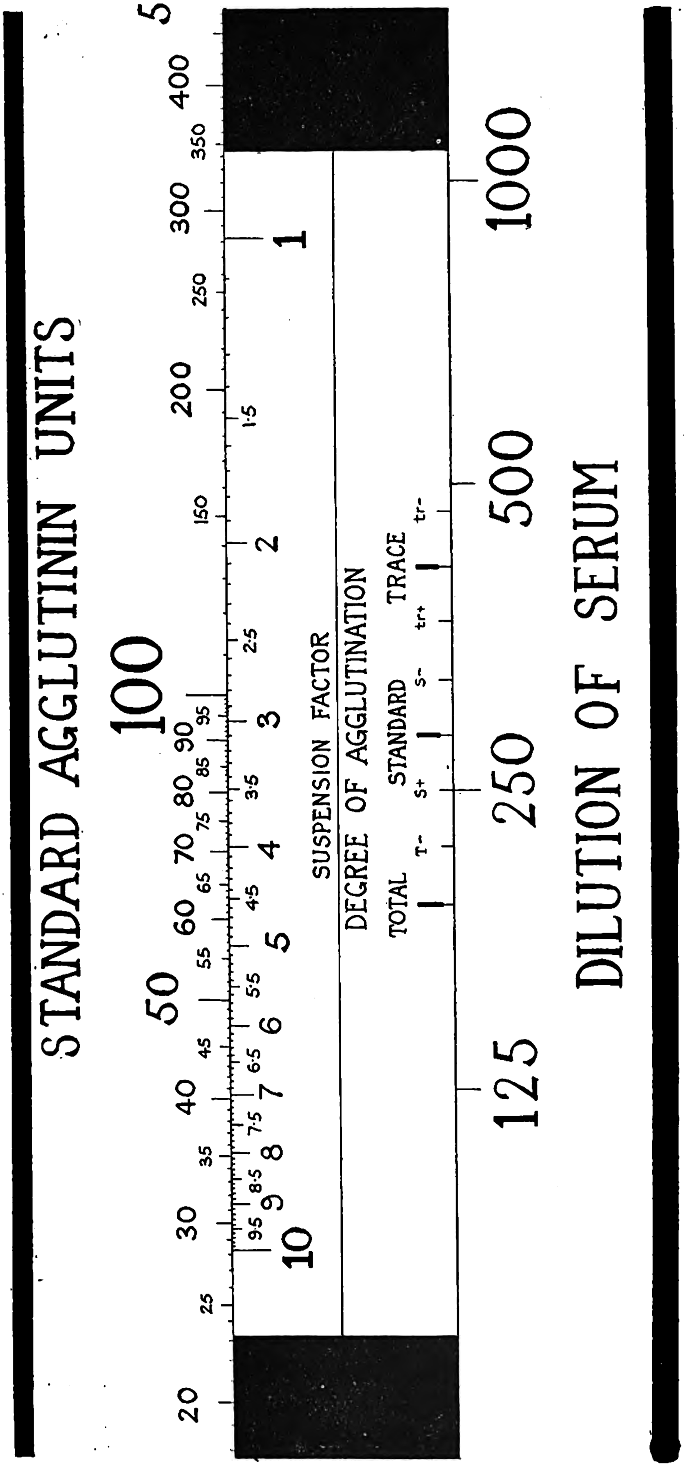
It now becomes necessary to decide upon a suitable length for the slide-rule, and it should be remembered that, other things being equal, the greater the length the greater the accuracy. The first apparatus of this kind that was made had a length of eight feet. This proved to be completely accurate to two, and almost to three, "significant figures." But it was a somewhat unwieldy piece of furniture, and an overall length of forty-four inches will be found to be more suitable. The drawings reproduced have been copied from a slide-rule of this length, a number of figures being omitted in the interest of simplicity. Its scale of standard agglutinin units or reduced titre reads from 1 up to 10,000 in four base-lengths, each of ten inches, with a margin of two inches at either end. It is accurate to two significant figures, which is quite satisfactory for the purpose.

Unless one is an adept it is advisable to entrust the wood-work to a carpenter. The requirements to form the rule are as follows: A piece of half-inch wood 44 inches long by 6 inches broad, to the upper and lower thirds of one face of which are screwed two pieces of half-inch wood 44 inches long by 2 inches broad. The edges of these two pieces facing one another are undercut slightly, in order to retain the slide in the groove between them. The slide itself is 12 inches long and rather more than 2 inches in breadth. Its edges are planed so that it fits comfortably and runs easily from end to end of the groove. The appearance in section is shown in the diagram.

The wooden rule and slide having been delivered, slips of thin white cardboard or stiff paper are cut to size and glued to their surfaces in the manner shown in the drawings. The cardboard or paper should be of a close texture and with a shiny surface, and must be of such quality that the ink which it is proposed to use does not run, either when first applied



(1) General view of slide-rule showing the positions of the four scales.



(2) Near view of slide to show method of reading the result of a test.

or after the coating of gelatine, which will be given later. Probably Indian ink is the most suitable, though the writer only has experience of ordinary blue-black writing ink, which he has found quite satisfactory.

Preparations are now complete for drawing in the scales. This is done in the first instance with a hard and sharp-pointed pencil. Faint marks are made, which are afterwards inked in with a fine-pointed pen. The upper portion of the rule, carrying the scale of reduced titre, should be completed first. The figure 1 is placed at a point two inches from the left-hand edge, and the figures 10, 100, 1,000 and 10,000 are drawn in at distances of 10, 20, 30 and 40 inches from the figure 1. In this manner the accuracy of the scale is ensured throughout its whole length. The positions of all other numbers appearing on the scale, and of intermediate unnumbered graduations, are found by reference to a book of logarithmic tables. The logarithm of each number is multiplied by 10, which gives the distance in inches from the position of the figure 1. If the slide-rule were being made of half the length recommended, the logarithms would be multiplied by 5.

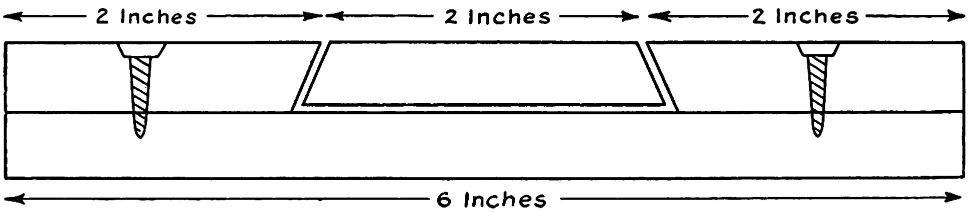


Diagram to show cross-section of slide-rule.

An attempt should be made to work to 0·01 of an inch, and for this purpose three-figure logarithms are required. Thus, if it is desired to find the position of the figure 46 : its logarithm is 1·66276, and therefore its position on the scale is 16·63 inches from the figure 1, or 6·63 inches from the figure 10. A ruler graduated in tenths of an inch, of the kind that may be obtained in any stationer's shop, is suitable for the purpose, and by its help the distance of 0·63 in advance of 0·6 can be gauged by the eye with a sufficient degree of accuracy.

After the scale of reduced titre has been constructed, that showing "suspension factor" should be undertaken. This is placed on the upper half of the slide, and is a counterpart, in the reverse direction, of the base-length 1 to 10 on the scale of reduced titre. The figure 1 is placed at a point approximately one inch from the right-hand edge, and the position of the figure 10 measured off at a distance of ten inches from it. Intermediate figures and graduations are then filled in, as in the case of the scale of reduced titre.

The positions of the points showing "degrees of agglutination" are now marked in on the lower half of the slide. The point "standard" is first indicated, and although its exact position is immaterial, it should be approximately in the centre. The positions of the other degrees of

agglutination are measured off to the left and right of "standard"; since they introduce the idea of negative logarithms, their exact positions relative to "standard" are given below:—

Degrees of agglutination	Reduction factor	Position in inches	
Total	1·47	1·67	To left of "standard"
Total minus (T –)	1·29	1·11	
Standard plus (S +)	1·13	0·53	
Standard	1·00	—	
Standard minus (S –)	0·88	0·55	To right of "standard"
Trace plus (tr +)	0·77	1·13	
Trace	0·68	1·67	
Trace minus (tr –)	0·60	2·22	

The scale showing "dilution of serum," situated on the lower half of the rule, must now be completed. To find the position of the figure 25 on this scale, move the slide until the figure 1 on the suspension factor scale is opposite 25 on the scale of reduced titre, and mark in the position of "dilution of serum" 25 opposite the point "standard" on the scale showing degree of agglutination. The positions of all higher dilutions are found in the same manner.

The slide-rule is now complete, with the exception that, for purposes of preservation, it should be varnished. After the ink has thoroughly dried, a preliminary coating of gelatine is given to prevent the varnish from permeating the interstices of the cardboard and rendering it translucent. The gelatine solution is made by dissolving a sheet (3 inches by 8 inches) of Coignet's gold label gelatine in 50 cubic centimetres of water. When this coating has dried the varnish may be applied. A suitable varnish is Rowney's paper varnish.

To use the instrument, the slide is moved until the degree of agglutination observed in the end-tube is opposite the dilution of serum present in that tube. The reduced titre of the serum is then read off opposite the suspension factor of the emulsion. In the "close-up" drawing the slide has been set to illustrate the reading of a test in which standard-plus agglutination has occurred in a dilution of 1 in 250. It is interesting to work out actual results in reduced titre, to determine how far the reading of the slide-rule differs from the calculated value. The discrepancy will be found to be less than one per cent, an error which is not likely to lead to a mistake in diagnosis.

———

OUR STATION.

By OLA.

(*Continued from Vol. lvi, p. 433.*)

"Now then, Kilo," shouts Pom, "step this way. Gentlemen, allow me to introduce you to the Chairman of the West End Universal Providers. Anything from a cap badge to a caster. Show the distinguished visitors over your rebate factory, young fellow"; and turning to us he whispers: "Our Kilo is a jolly good P.R.I."

Kilo blushes and looks awkward. "No kerosine butter and no pork in this establishment, gentlemen. An honest deal, small profits and scrupulous cleanliness is our motto. With a motto like that you can't afford to push a line in pork—can you, Pom? though not for the world would I suggest that the piggery was financed by you."

"You don't 'suggest'? I should think not, and confound your impudence!" roars the affronted Pom.

This rally refers to the discovery, made yesterday, that Pom's bearer—a Hindu Christian—has been running an illicit, but profitable, cantonment piggery in the servants' quarters attached to the officers' mess. Boot-legging in pork, in fact.

Pom's outburst is much appreciated by the owner of a laugh which sounds like the creaking of a heavy oaken door swinging on rusty hinges. It is a laugh based on chronic bronchial asthma. The asthmatic one is Khan Sahib Taffazal Husain, and the worse his complaint the more cheerful, risible and spasmodically expectorant does he become. During attacks he is like a jack-in-the-box; in the middle of a conversation he will suddenly disappear, and strange and distressing noises follow his exit. In a minute or two he will pop up again, a little shaken, but less wheezy. He is a polite man, but too unsophisticated to use a pocket handkerchief.

The arrival of the Khan Sahib initiates a series of events of psychological interest, At first the old man keeps in the background; the only thing noticeable about him is his laugh. Presently you observe that he is standing at the elbow of the C.O. or P.R.I. and acting as a sort of privileged prompter. At this stage his sudden, occasional disappearances (cum guttural noises) become evident. Finally he dominates the scene, takes charge, laughs as heartily as the rust will allow, and vanishes round the corner and comes back again with elaborate, if hasty apology such as: "'Tis the will of Allah, but—Your Honour understands"; or "A moment, O! Protector of the Poor." Relations become so intimate that you feel you ought to slip into privacy with him and pat him between the shoulder-blades; but you would have to be careful and gentle about it, for the Khan Sahib is a frail, wizened little creature. He is clad in a quilted garment—a

sort of tailored eiderdown—shaped like a frock-coat buttoned up to the neck; black, with a pattern of red rambler roses and lovers' knots in blue. A black lamb-skin cap like a small busby, voluminous Punjabi trousers and red leather shoes from Delhi complete his costume.

Khan Sahib Taffazal Husain is not only a beau, a character, and an aristocrat in his own sphere—he is an Important Personage. He is the regimental contractor—indeed, he is the owner—of the institutes of the 22nd Cuirassiers, the Royal Horse Marines and many other units in the Punjab and N.W.F.P.

The institutes are tastefully decorated in white, royal purple and grey. A liberal, but neat, application of whitewash, a lavish powdering with chloride of lime, a display of numerous basins of freshly made "pinky" and the formation of streams and puddles of cresol solution provide the ingredients of the colour scheme. The artistic effect is slightly marred by the bright henna-red hue of the proprietor's beard; but one cannot have perfection.

With the exception of a few years' interval, the Khan Sahib has been at the game since 1874, when he was introduced to the business by his late father, Najmul-Islam Bahadur. He is an adept at passing sanitary inspections with a "d." He will even show you receipted bills for bleaching powder, potassium permanganate and cresol—to prove that, if your hospital stocks are becoming mysteriously depleted he, at least, has no hand in it.

The interval mentioned above occurred during and after the war. The old system failed at the outset; the Army made an attempt to run its own show and, in the end, to get rid of the regimental contract system altogether. But Indian conservatism, vested interests and, above all, low overhead expenses of a native, as compared with a British, establishment defeated the Army scheme. Taffazal Husain and his like have returned triumphant and will remain in possession—until the next big war breaks out at any rate.

"Very good, Khan sahib: no complaints. Oh! by the way, how is your friend the Cantonment Executive Officer? I hear he has been indisposed."

"Nay, sahib, it is unseemly to poke fun at an old man. As Your Honour knows full well, the Cantonment Executive Officer is no friend of mine. And as for his alleged indisposition (would it were true) may Allah be glorified by the idolator's early demise! The extinction of a man who worships a monkey cannot but benefit the enlightened."

"And what about his sorrowing family?"

"Bah! The widow will commit suicide, thank God. The daughters can devote themselves to the service of one of their unholy temples—of which, by the grace of the Almighty, I have heard much and know nothing—and the sons, being uncircumcized, may starve; and the longer and more lingering their sufferings, the better."

"Taffazal Husain, thou art a wicked old man. I pray that God may endow thee with a modicum of charity before long. Salaam."

"Salaam, Lord Sahib, and may your years outnumber the rose petals of Shalimar; may your male descendants cover your name with all honour and glory. Salaam!"

In the serjeants' mess, Quartermaster-Serjeant Partworn draws off a glass of the famous Kulu beer, and is much relieved when you refuse it with: "No, thank you: not before sundown." The fact that he expects you to say this in no way diminishes his anticipatory delight. In accordance with the accepted ritual, you now proceed to admire the signed portrait of H.M. The King, which hangs over the mantelpiece. Time: seven seconds. This is long enough to permit the Q.M.S. to put down the beverage from Kulu and to wipe his lips with a jahran extracted from a pigeon-hole marked "Monday."

On arrival at the West End married quarters, we find it is imperative to point out to Mrs. Corporal Spurs that the hillside behind her residence is adorned with an unusually large number of empty tins and broken bottles. Mrs. Spurs, who has been upbraided for this kind of thing before, receives the news somewhat coldly and replies, in a disinterested fashion, that Mrs. Serjeant Surcingle knows more about it than anybody else. Mrs. Surcingle, hitherto invisible, suddenly pops her head out of a nearby window, and reckons that she don't hold with tinned stuff. And as for bottles—well—the less Mrs. *Lance-Jack* Spurs talks about bottles, the better. The effect of this is considerably enhanced by the alarming appearance presented by Mrs. Surcingle; she has been washing her hair; and everyone is taken aback—except Mrs. Spurs, who remarks that the soft soap has its work cut out.

It is at times such as these that Pom shows the worst side of his character. He simply fades away, and leaves me to face the music, with Quartermaster-Serjeant Partworn hovering in the middle distance to ensure that Hygiene shall have that powerful backing which only Administration can afford.

The road now descends gently between the long barrack blocks of the 22nd Cuirassiers on the right and the Royal Horse Marines on the left. The two units are engaged in a perpetual, friendly rivalry. The fire buckets of the Cuirassiers are a flaming scarlet, with "Fire" neatly printed in white. Each bucket stands in a tiny square marked off by whitewashed stones. The buckets of the R.H.M. are of a crimson lake colour; "Fire" is in big, bold letters of yellow, and each bucket is mounted on a small mound of puddled clay. The Cuirassiers are fond of monkeys; the R.H.M. favour green parrots. The Cuirassiers go in for marigolds and cosmos, but the R.H.M. prefer hollyhocks and sweet peas. However, in one respect the two units are indistinguishable; in both the dogs are innumerable, and variegated beyond belief.

The end gable of the last barrack stands on the edge of a steep gradient Here Pom and the Q.M.S. take their leave; Kilo waves a farewell from the steps of the guard-room, 200 feet above; and we turn our backs on the West End and enter the domain of—

Mr. Hanuman Junwar,
Kaiser-i-Hind (3rd Class)
Cantonment Executive Officer,
Our Station.

Prior to 1924 cantonments were looked after by Cantonment Magistrates—mostly British officers, I.A., permanently seconded to the Cantonment Department. Now we are being Indianized, and Mr. Hanuman Junwar is our share of the process. He is a transfer from the Military Accounts Department, in which he led a vegetative existence for over twenty years. He is married, age unknown, thirteen children, passed matric. Punjab University, and failed B.A.

Like Kahn Sahib Taffazal Husain, Mr. Hanuman Junwar belongs to a generation and school of thought which is fast passing away. He is an old-fashioned round peg in a modern square hole; but he is an optimist and, except for occasional doubts and disappointments, he does not realize that the receding tide of the recent past has left him high and dry on the shingle. Also, like the Kahn Sahib, he is old-fashioned in the choice and ardency of his likes and dislikes; and there the resemblance between the two men stops. Physically, Mr. Hanuman Junwar is so big and so round that he is like a colossal Toby jug, and he is quite unable to wedge himself into any chair with arms. This disability prevents him from moving about and seeing things for himself—an unfortunate circumstance, since he is compelled to delegate his outdoor work to subordinates and to rely on hearsay for information.

In India, above all places, hearsay is a weak reed.

Our C.E.O. has one other defect; he cannot speak fluent and idiomatic English. Unfortunately we cannot speak fluent and idiomatic Hindustani; but we are in the stronger position for, whereas we are well aware of our linguistic limitations, Hanuman Junwar is in proud and innocent ignorance of his. It is not his fault because, when he was in his heyday, British officers talked and thought in the vernacular; it was not the custom to converse in English with an Indian. Now all that is changed; and even if the C.E.O. were aware of his weakness, he is now too fat and fossilized to effect repairs.

Mr. Hanuman Junwar's office is on the southern aspect of the ridge, and is surrounded by all the odds and ends—the waifs and strays—of the station, clinging like limpets to the steep declivity. The British cemetery, the Sikh gurdwara, a wood stack, quarters for the conservancy personnel, a humble bazar, a red post box and a yellow dog, bits of rusted wire, a few corks, pieces of tin, some stunted bushes and millions of stones. A slippery site, baking in sunshine and dangerous in rain.

Look! there is the squire, basking in front of his office: enormous grey-white pugri, Kashmir shawl in natural colours bordered and fringed in emerald green, grey-white Jodhpurs and patent leather shoes. The figure is majestic, but the drapery would be none the worse for an application of Lux.

"Good-morning, babuji. How are you?"

"Good-morning, sir. I am A1, at Lloyds, thank you."

"And the family?"

"By the grace of Almighty Providence, in astounding and astonishing states of health."

"You will be good enough to convey my salaams to Mrs. Hanuman Junwar in due course?"

"By God, sir, that is act of glorifying kindness! Not since pre-War has post-War friendly message not been sent to my wife. Sir, on my wife's part you will accept heartfelt gratitude. Often my wife and childrens are praising Your Highness's magnanimity, of which we do not see so little these subsequent times. My wife endures pain in belly since cessation of suckling of last-born. What, sir, is good for such indispositions?"

"H'm. By the way, babuji, Taffazal Husain tells me that none of his men is allowed a cantonment hawker's pass except on payment of annas ten. But, as you know, the cost of a pass is annas eight. What have you to say to that?"

"Major sahib, I am man of peace. You are aware that my religion forbids me to harm even bluebottles. But, sir, if I were man of war I would consider it exigencies of Service to order execution of Khan Sahib Taffazal Husain forthwith. He is bad man."

"That is all very well, babuji, but it does not excuse, or even explain, this surcharge of annas two."

"I make clean breast. Your Highness knows all and understands all. No doubt office chuprassi Jag Das solicits annas one; he is a humble man and poor. Perhaps writer Prem Singh requires annas one also; he is man of large family and mean emoluments. These things may be; and would you have me to take necessary actions to encourage this rich fellow, Taffazal Husain, to rob the pauper and impoverish the father of the naked and hungry? No, sahib. I swear treasury, Likhnabad, is credited annas six only per pass."

"Very interesting, but not altogether satisfactory. For instance, neither the chuprassi nor the writer is a Muslim. Have you ever contributed to the welfare of any Mussulman?"

"Yes, sahib, I have; I pay my taxes without fail not later than 25th instant per mensem." Hanuman Junwar says this with a sly twinkle in his eye, and then quickly adds: "whereas Khan Sahib pays his dues not sooner than 25th proximo per mensem—ha-ha-ha!"

You think our C.E.O.'s English is not so bad after all?

Well—perhaps you are right.

Our Station is a judicious mixture in which there is much to praise and not overmuch to censure. However, there is one nasty blot on the landscape. Were this a natural, inevitable, ineffaceable blemish it might cause us a certain amount of sorrow and distress; but it is not this kind of disfigurement; it is artificial and remediable and, as such, its continuance fills us with considerable humiliation and shame.

When we show our friends the beauties of Our Station, we steer them clear of the British cemetery.

You are a privileged visitor, and you are not a hard-bitten materialist; therefore, I propose to let you see the place.

"There is a certain frame of mind to which a cemetery is, if not an antidote, at least an alleviation. If you are in a fit of the blues, go nowhere else."

When R. L. Stevenson wrote that, he had not inspected the cemetery in Our Station.

The cemetery is square-shaped, and is bounded by four low walls which stand in need of repair. It is terraced, but the terraces are pitched on such an acute slope that one fears for their safety—and the safety of their contents—should the slightest tremor afflict the earth's surface. The ground is divided into small areas allotted to the C. of E., the R.C., and "other denominations." Each reservation is indicated by a dingy notice board; but the shale, loose stones and noxious weeds which fill the place are no respecters of creeds, for each parcel of ground is equally dismal, dreary and dilapidated looking. Printed across this poor, starved acre you read the grim word "NEGLECT."

There is a double gate in the upper wall. It is always open, and nobody takes the trouble to close it. Facing this gate is a small building. You and I would call it "a godown," but its official title is "the robing room." It has a door, permanently ajar, and nobody seems to be responsible for keeping it shut and locked.

Most cemeteries in occupied cantonments in India are guarded and tended. Here there is neither a chaukidar to chase away the pariahs, nor a mali to keep down the weeds.

There is not even a chaukidar-mali.

There are just two clergymen of different denominations and a slogan.

Well, of course, you have guessed what the slogan is: "Financial Stringency"; and as neither you nor I belong to the M.E.S., we cannot do anything about that. But why should not the the two padres join forces

and do something? A house divided against itself is no match for the plea of financial stringency; but supposing our two reverends were to call a meeting of *all* denominations, in the cemetery, and open the proceedings by singing Hymn (A. and M.) No. 215, it cannot be doubted that some good would come of it. Meanwhile the poor little cemetery is simply aching for the human touch, and surely this could be provided without much trouble or expense—on the condition that you are not too critical or fastidious. A simple inscription above the open gateway, for instance. That would not cost much; about half an anna a letter. What shall it be? Something sardonic, after the fashion of the American road notices to motorists?

HERE IS THE LIMIT OF FINANCIAL STRINGENCY. *KEEP AWAY.*

Or something said, like this:—

". . . AND LET THE DEAD BURY THEIR DEAD."

Or in a cheerful spirit, thus:—

"EAT, DRINK AND BE MERRY, FOR TO-MORROW WE DIE."

No; none of these is quite fitting. In the face of this example of the length to which financial stringency can go, the philosophic vein is more appropriate to the circumstances, e.g.:—

ON ENTRE, ON CRIE, ET C'EST LA VIE;
ON CRIE, ON SORT, ET C'EST LA MORT.

At parade service last Sunday we sang No. 437, Hymns A. and M. You know the fifth and sixth verses?

And when the strife is fierce, the warfare long,
Steals on the ear the distant triumph-song,
And hearts are brave again, and arms are strong.
Alleluia!

The golden evening brightens in the west;
Soon, soon to faithful warriors comes their rest;
Sweet is the calm of Paradise the blest.
Alleluia!

Yes, that is very beautiful: "Soon, soon to faithful warriors comes their rest." And yet, when I whispered to the Honble. Charlotte—"Think of our cemetery now"—she looked daggers at me.

That is the Honble. Charlotte all over.

Deep in the heart of the forest I know a lovely, grassy glade. It is bounded by big, grey rocks which, in turn, are encircled by giant pines. Wild flowers grow there, and birds and butterflies haunt its fresh stillness. When I die I wish to be planted in this sanctuary—far away from financial stringency. I mentioned this to the Honble. Charlotte, she being the most

reliable and sympathetic person in Our Station. Her comment was typical. "All right, I'll see it is done; but when I die I shall be quite content to lie in the weed reserve. Trooper Smith and Baby Brown are already there."

That is all very well; but I do not think that the Honble. Charlotte looks at the situation from the correct angle. There is too much sentiment and too little protest in her remark. Glance across the hillside towards the Sikh gurdwara. From the outside it does not resemble a temple; but it is well built and in excellent order; it is clean and tidy; the paintwork is fresh; there is grass in front, bushes on each side and trees behind. There are no weeds. It is a simple, unpretentious structure, but it and its surroundings have an air of self-respect; they are not financially stringent.

Let us hope that none of the Sikhs on the balcony of the gurdwara are glancing across at the British cemetery.

Before leaving this neighbourhood we must pass the time o' day with old Bobad who keeps the baniya's shop in the little bazar. He is like an aged horse because, no matter how much food he may consume, he will never fatten. The pits in his cadaverous cheeks betray the fact that he is completely edentulous. The sunken eyeballs indicate a minimum of post-orbital fat. The scraggy arms and legs are devoid of any adipose tissue; they are almost skeletal. His skin is unusually dark; in contrast with a heavy white moustache and big gold earrings, it appears nearly black. His faded orange-coloured pugri might pass muster, but the rest of his clothing is not even up to the standard of the meanest jumble sale. Outwardly, Bobad is not prepossessing; his portrait would make good propaganda in an appeal for famine relief. But we must not judge by what meets the eye, for Bobad is a merchant and usurer of substance and property, and his wretched physique, poverty-stricken appearance and ramshackle premises are actually business assets in this land of paradoxes.

The baniya sits in his shop surrounded by bags and tins of rice, atta, gram, ghi and gur. Sometimes he lies on top of his comestibles and dozes. Scattered about in corners and on shelves are the lesser articles of commerce: sulphur-tipped Swadeshi matches, six-a-penny Rob Roy cigarettes, fearful and wonderful spices, powdered antimony for the babies' eyes, onions, garlic and third grade kerosine oil. Affixed to a shutter is a smudged and tattered poster announcing that Dr. Chiranju-Lal, Dental Surgeon (retd., I.M.D.), of Likhnabad, visits Our Station on the first Monday of every month during the season. Extractions, annas twelve; fillings, rupee one.

Bobad caters for the proletariat. He is also a money-lender. It is true that he only deals in small amounts; but his transactions are extensive, for most of the natives in and around the place are in his debt. Interest is charged at the rate of 1 anna per rupee monthly, i.e., 75 per cent per annum; and for all the blessings bestowed upon him Bobad renders thanks to the great Shiva (or, as he says, "Shankar") the bringer of good luck.

The little shop is the village pump of Our Station; it is frequented by all and sundry although, of course, social distinctions are carefully preserved. Thus, a broken-down cane chair has been brought out for the comfort of Civil Sub-Assistant-Surgeon Abinashi Ram, and in deference to this gentleman's Western leanings. Abinashi Ram wipes his gold-rimmed spectacles, attempts to sit on the chair as if he had never sat on anything else all his life and, after five minutes of torture, squats beside old Bobad on the floor of his shop. The S.A.S. is the district vaccinator and has just been inoculating the baniya's youngest grandson. Undoubtedly, a visit from the Goddess of Smallpox is a fortunate event for any household; but, when you live in a British military cantonment, it is easier to run the risk of Her wrath than to be on the black list of the sirkar, and especially of the sirkar's cantonment health officer.

On a bench in front of the shop are squatting Hoshyar Ali, the carpet dealer from Peshawar, and Yaran, the head pony man. The latter is inspecting second quality grain and trying to calculate the minimum amount necessary to keep his wretched animals alive—and just alive. The former is sipping sweet, highly spiced tea of a pale mauve colour, from an imitation Russian cup. He is in fine fettle, for he has managed to infect Our Station with an epidemic of carpet buying. Sales amount to Rs. 3,000, with a profit of Rs. 1,750, and the epidemic has not yet died away.

Hoshyar Ali's stock-in-trade is divided into five bundles, each weighing at least 160 pounds. These bundles are carried on the backs of five Kashmiri coolies who come from a little village near Tangmarg. They are cheery, powerful fellows who deserve and earn good pay, and contract enormous appetites in the process. At present they are squatting behind the bench, close together in a circle, gossiping (the word "paise" is of frequent occurrence in the conversation) and smoking a communal and very dirty hookah; three short, quick puffs apiece, and pass.

The Mall continues its steep downward descent below the bazar and from here, on a clear day, we obtain a good view of Likhnabad.

This article purports to be a description of Our Station, and so it is not possible to say much about Likhnabad, the hub of our small universe. Were one to attempt a description of the latter, there would be an end to any further remarks on the former. Those who live in the backward mofussil will forgive. They may even applaud—secretly. Those who live in the mountain hive of inky industry and super-cerebration will condemn. Nevertheless, and even at the risk of retaliation, it is essential to preserve herein a proper proportion. It must suffice to say that, in Likhnabad, there is a club, a cinema, an A.D.M.S., a D.D.M.S., six Specialists, twelve hotels, and about twelve hundred babus with books of regulations (amended) and typewriting machinery complete.

Our Station is not endowed with any of these advantages. We cannot compete.

Let us resume our humble peregrination.

"Hold on a moment," you exclaim; "what is a Specialist?"

A Specialist is a man of two moods and two phases. In his expansive mood he tells you about other people's mistakes; in his reticent mood he does not tell you anything. In his phase of slackness he gives you good advice and much help; in his phase of activity he says (*a*) "Go to the devil"; or (*b*) "I'll do it, though I can't understand why you don't do it yourself"; or (*c*) "Right! it's up to me, sir. Excuse haste." The choice of (*a*) (*b*) or (*c*) depends on circumstances, the chief of which is relative rank.

A Specialist does not know the difference between an Operation Order and an Appreciation of a Situation, but he is a very rich man.

The badge of the Order of Specialists is a chunk of Aberdeen granite, denoting immovability. On one side of it is inscribed "Dermatology," "Obstetrics"—or whatever the specialism may be—together with the motto: "Responsibility walks hand in hand with capacity and power." On the other side there is engraved a representation of a golden guinea, and underneath this the battle-cry of the Order: *A bas l'O.M.O.*!

Let us continue on our insignificant way.

Here are the East End officers' mess and bungalows. At this time of day the exigencies of military service prevent the officers from being at home; but, with any luck, we should find their ladies in residence; it is the convivial hour of "Elevenses."

Although we are now a thousand feet below the dairy, yet we have reached the zenith of our tour.

The spiritual transcends the physical.

What has passed has been but a prelude and, after you have met the wife of the Commandant of Our Station, what will follow will be but a decline.

Allow me to introduce you to the chatelaine of Flagstaff House, the Honble. Charlotte.

I first met the Honble. Charlotte at the International Horse Show at Olympia. It is true that she was careering round the arena on a big grey gelding, while I was occupying an obscure position in the five-shilling seats. Nevertheless, something told me that I and the Honble. Charlotte were good friends. It was not a personal affair. I was not allowed to monopolize the lady. Every member of the vast audience, women and children as well as men, felt that here was a pal; and each was well pleased to share her with his neighbour. The best of it was—or perhaps the reason of it was—that the Honble. Charlotte was as happy and delighted with our company as we were with hers. Even "Sabretache," the gelding, tossed his head and flicked his tail as if to say: "Come on boys, don't sit there like a lot of tailors' dummies. Join us down here, the going's grand!" When the

Honble. Charlotte's magnetism is reinforced by her equine partner's flag-wagging messages, the appeal is irresistible and the response unstinted.

Not only does the Honble. Charlotte impress you with the fact that you are the one and only person in this wide, wide world, but she makes the units of a crowd feel the same thing. On an occasion such as this "Sabretache" may be guilty of a certain amount of play-acting; I suspect he is; but not so his adorable mistress. She is wholly unconscious, entirely serene, while her smile enraptures and her sincerity enslaves.

It happened during one of the important open jumping events.

The crack riders of half a dozen different nations had performed with varying degrees of success, but with a monotonously high standard of efficiency and skill. Wonderment and enthusiasm were yielding to boredom; the thing was too machine-like. Some of us were beginning to think of making tracks for home, when the big doors were thrown open, the band struck up Vesta Tilley's old song "Here's to the lass who loves a soldier," and competitor No. 9 cantered into the arena. It was at once evident to everyone that No. 9 and her mount were neither pot hunters nor Robots; they were out for the fun of the thing. The grey gelding swept over the tan with long, easy strides while his rider sat down in her saddle as if she were part of it—a perfect picture of grace, harmony, and power.

"Sabretache" took the first fence like a bird, and proceeded to put the remaining obstacles behind him with a minimum of effort and an air of artistry which captivated the audience and earned the approbation of the fairy on his back. The Honble. Charlotte was obviously pleased, and we were vociferously enthusiastic. Thus, without a fault, the difficult course was covered until the penultimate obstacle—a set of sloping rails—was reached. Here the gelding took off too late, crashed into the rails and turned a complete somersault. The Honble. Charlotte was thrown clear, but she hit the ground with some force and lay very white and still.

The band wavered and the rounds of cheering suddenly died down. It was an unpleasant moment.

Then a curious incident occurred: "Sabretache" picked himself up, shook himself heartily, and trotted over to where his mistress was lying at the same moment as grooms, ring officials and stretcher-bearers hurried in the same direction. However, this excited, jostling throng was too much for the grey; back went his ears, up went his tail, while he curvetted, sparred, lashed out, attempted to bite the chief judge, and scattered everybody to the four winds. The fury of jealousy.

The audience sat tense and silent. Vesta Tilley's song threatened to die of inanition.

The gelding stood over the outstretched, motionless little figure and neighed. Then he lowered his head and very gently stroked the white face with his muzzle. The figure stirred. It rolled over. It struggled to its knees.

That finished the band. There were murmurings amongst the audience.

A St. John's man, too daring, felt the whizz of a pair of hoofs which passed within a few inches of his head. The chief judge, who had lost his cigar, wrung his hands and retreated out of range.

The figure fumbled with the reins, patted the gelding's neck and seemed to whisper in his ear; and then, before we had recovered our wits, the Honble. Charlotte, hatless and radiant, was in the saddle! "Sabretache" whirled round, cleared the wreck of the rails in a flash and was over the last jump—a high gate—with a foot to spare, when the roof split. It must have split. Nothing could have withstood the tremendous volume of cheers upon cheers as the horse and his rider turned and faced us.

The great doors swung open again: the Honble. Charlotte and "Sabretache" were swallowed up in the gloom without; but the cheering continued and, after that, the rest of the show fell flat.

That is a digression. It is a long way from Our Station to Olympia. Also, it is an absurd piece of heroine-worship—but that is inevitable; to know the Honble. Charlotte is to fall in love with her, and to fall in love is to assume the mantle of irresponsibility. I make no apology.

Ah! You notice that her hair is chestnut and her eyes blue? but you have not seen her in the lamplight, when her locks shine like burnished copper and her eyes are grey. Well—grey, with a tinge of blue, perhaps; or so they say. Truth to tell, I am not sure about it. The colour varies, and each variation is more wonderful than the last. Then there is that breadth between the eyes, and the straight nose. Straight? Yes, surely. Maybe, as you say, it is slightly tip-tilted; but anyway, it is a beautiful nose. And the lips—firm, regular, naturally red; not a diminutive Cupid's bow, too small and mean to harbour steadfastness and generosity, but an ample, well-moulded affair in which you may place unbounded confidence. The fine forehead, the chin which denotes purpose without suggestion of obstinacy, the rows of regular white teeth of which you may catch a rare glimpse in moments of merriment, the voice—

Really? Well, I entirely disagree; it has no resemblance whatever to the sound of a muted organ. A silver bell if you like—or a nightingale—or the violas in Tristan's love song—or the voice of your dreams; but a muted organ—no, never! Have it your own way; I don't care; but—*I disagree*—that's all; and in any case it has no bearing on the fact that, to quote Trooper Seebee, the Honble. Charlotte is "'Eaven's own peach," or, as Mrs. Seebee says, "a haingel upon earth." The Seebees are manifold, and woe betide those who would contradict them on this subject. Neither Trooper nor Mrs. Seebee has ever heard of a muted organ, I'm sure, and that is a point worth remembering.

However, we must away. We have not yet exhausted the sights or met all the notable inhabitants of Our Station. And although the Honble. Charlotte is supreme, still, there are others who can rouse our admiration

or interest. It is written that there is a book into which some of us are happily led to look, and to look again, and never tire of looking. It is the Book of Man. You may open that book whenever and wherever you find another human voice to answer yours, and another human hand to take in your own.

For instance, look at the man who now approaches: the Commandant of Our Station, Major O'B. O'C. Cantle, D.S.O., of the King's Browns. If "the great man is he who does not lose his child's heart," then Cantle must be a great man indeed. He is always referred to as "the Honble. Charlotte's husband" or "Mary." Both are desirable titles. The former is easily understood; the latter is based on the line "Kind, kind and gentle is she," and this, in turn, takes origin in Major Cantle's special scale of punishments. His summary awards are not to be found in King's Regs. They run something like this:—

I. Well—you ARE *a prize donkey. Go away.*
II. You ARE *a d—d idiot. Clear out.*
III. You ARE *a b—y fool. Get out.*
IV. Severely warned. March him out.

The remarkable thing about this scale, as handled by Mary, is this: that it seldom fails to produce the desired effect. It is rumoured that, as soon as an evil-doer returns to his barrack room, Mary's troopers deal out to him what his Commander has omitted; but be that as it may, there is no doubt that Mary's squadron is the most efficient and best disciplined in the regiment, and that Mary's popularity with the men knows no bounds. Naturally, these men are dubbed "Mary's little lambs"—outside their range of hearing, of course.

Mary is a modern Sir Roger de Coverley.

Our Commandant is assisted by a station staff officer, Captain John Company, 1st Battalion the Goomshire Regiment.

Mary lays down the broad outlines of policy. John Company fills in the detail and sees to its execution.

Company is the proud possessor of the nickname "Milord." To understand the significance of this, and to appreciate Milord's characteristics, let us glance for a moment at a piece of regimental history. The following is an extract from General Sir George Grosvenor-Millbanke's monumental work, "Infantry Annals" (Pale and Golden. Bisley. 1881. Pp. 957. Twenty coloured plates. 17s. 6d.):—

"THE GOOMSHIRE REGIMENT.

"This magnificent regiment is doubly fortunate, inasmuch as it is composed of two battalions which—prior to the fatal scheme invented and carried out by the late Mr. Cardwell—were equally renowned in peace and war, in chivalry and the chase, in love, loyalty and devotion.

"The 1st Battalion, now lying at Mian Mir, was originally the 149th

Foot, raised in the North-west Riding in 1715 as Jorrock's Fencibles. The badge of the 149th Foot was a Yorkshire ham, bone *in situ,* and bore the legend 'Ba Goom.' It seems that when the regiment was hot on the tracks of the Old Pretender, the latter was heard to exclaim : 'Tae get the legs o' yon fencibles, a body maun first fillet them—ba goom!'

"The 2nd Battalion, at present engaged in the autumn exercises on Wimbledon Common, was originally the 150th Foot, raised in the South-east Riding in 1745 as the Duke of Whalley's Militia. It is recorded that, when the unit was encamped on the slopes of Ben Achiltibuie, Flora Macdonald, disguised as a *fille du régiment,* visited the lines. Her beauty and blandishments overcame the gallant colonel, whom she induced to grant her an interview *in camera.* No one knows what happened ; but, on the following morning, when the colonel's bâtman stepped over the door-flap with the chhota haziri tray, he was only able to ejaculate the one word 'Champion!' before falling on the ground in a dead faint.

"At this point the old regimental records become somewhat involved : much is made of a court of inquiry assembled to determine the value of the pots, tea, earthenware, officers', for the use of, 1, and other articles broken, and to decide whether the cost should be borne by the individual concerned or by the State. The bâtman, Militiaman Steadfast Peat, was definitely in favour of the latter course. In evidence he stated that, on the previous evening, when about to enter the tent with the colonel's warming pan, his master shouted in a loud and angry voice: 'Go away, dunder-head! Two dozen lashes for you in the morning!' This was followed by a peal of silvery laughter which, Peat declared, was quite unlike the sounds made by the colonel when amused.

"Eventually the court decided to charge the damage to the colonel's estate.

"In a footnote it is explained that the bâtman fainted because his master was lying in a pool of blood on the floor of the tent, with a Highland dirk stuck in his chest.

"There was no trace of the erstwhile *fille du régiment.*

"This, then, is the origin of the badge of the 150th Foot : a Yorkshire ham impaled by a large knife, over the word 'Champion.'

"Thanks to the efforts of Her Majesty the Queen, the Prince Consort, the Commander-in-Chief, the Board of Directors of Messrs. Holt and the Committee of the In and Out, the two battalions have been able to come to an agreement on the matter of the new regimental badge : a ham, bone *in situ,* transfixed by a Celtic dagger. However, Mr. Cardwell's reluctant permission was obtained for the retention by each battalion of its distinctive legend. This is all to the good, and has an important bearing on *esprit de corps.* It is true that a first battalion man strongly resents the pronouncement of the word 'Champion' in his hearing ; and a second battalion man becomes frenzied if addressed as 'Good owd Ba Goom.' Many more or less serious affrays have occurred in consequence of the passions roused

on this account. Still, the preservation of old customs and traditions in the British Army is of more importance than a hundred broken heads."

After that it will not surprise you to hear that Milord's visiting cards are printed thus :—

"Captain John Company,

"149th Foot (Jorrock's Fencibles)."

If you address him as an officer of the Goomshire Regiment he may forgive you; but if you write "1. Bn. the Gooms," you make of him a bitter and implacable foe for ever.

Milord is a hard worker. He gets through the business of the day at hurricane speed, expends a maximum amount of energy himself and drives his subordinates to great deeds or drink. But there is no fuss: it is all done in a quiet, relentless manner, with a degree of efficiency which is not supposed to be possible outside Likhnabad or Army Headquarters. He finds time to study for the Staff College Entrance Examination, to keep himself up to date regarding the vintage properties of the old-fashioned wines, and to read the leaders in the *Pioneer*, the latest Russian novel and the Intelligence Summaries. In official life he seems to be a stern disciplinarian, and in private a humorist of the cynical type. When you know him well you find he is wearing an iron mask: the real Milord is very kindly and full of charity.

Milord is a Personality—ba goom!

On leaving the station staff offices you will notice a scattered collection of buildings on an eminence to the left of the Mall. Most of these buildings are low and long, and are protected by deep, shady verandahs. The grey stones give an impression of solidity: the freshly painted woodwork has an air of cheerful optimism; and the tall trees, the green grass, the scented roses and sweet peas carry one's thoughts to England, home and beauty. Here is to be found contentment and rest, and here—as you may have guessed—stand the British military and families' hospitals.

We are greeted by Assistant-Surgeon Le Quesnoy and Matron Mrs. Breach. The former you already know: the latter is an important person who must receive more than passing mention.

Mrs. Breach is built on ample lines more suggestive of ballast than grace. Her complexion is seamed and tanned by the sun of many hot weathers. Her voice has suffered from a constant, double forte reiteration of the famous "Koi hai?"—that query which so often remains unanswered in this land of mystery and concealment.

Mr. Breach, a driver on the B.B. and E.I., married her when she was only seventeen. They begat seven children, of whom four now survive. After seven years of connubial existence with a slight admixture of bliss. Mr. B. departed to make his fortune on an engine in French Indo-China. That was twenty-seven years ago, and Mr. B. has not been heard of since.

Perhaps, one fine day, he will turn up again. Mrs. B. hopes he will not, and continues to support an invalid daughter and to pay the silly debts of an erring son. Her two remaining children have done well: one teaches embroidery in the convent school of St. Katerina della Goa in Bombay, and the other plays the banjolele in Jazzorini's Calcutta Dance Band.

Mrs. Breach may be disillusioned, but she is not soured.

In the hospital she exercises a good deal of discrimination with the general class of patient. The genuine sufferer receives unstinted care and sympathy; the grouser, the person who is bent on rejoining her husband in the plains in mid-August, the individual who haunts the out-patient department because she has nothing else to do, the mother who neglects her children—these receive summary treatment. This treatment ranges from indifference to frigidity and even to actual hostility, depending on such circumstances as the state of the weather, the efficiency or otherwise of Mrs. Breach's powers of digestion, or "the monkey tricks" (to use Mrs. Breach's phrase) "o' them blessed hospital ayahs."

With maternity cases it is quite another story. In this class everybody—the good, the average and the bad—occupies a high place in the matron's affections, and remains there unless a flagrant misdemeanour is committed. A bottle of stout may be smuggled into the hospital and matron will shut the near-side eye; but the surreptitious administration of brandy to a fractious infant is apt to cause a passing breeze.

The East End Serjeants' Mess is run as a mixed station club, of which Mrs. Breach is a most popular member. In partnership with Squadron Serjeant-Major Oddson she manages to win most of the tournament "doubles." Squadron Serjeant-Major Oddson has the face and figure of a professional jockey. From a tactical position in the centre of the court he rushes here, there and everywhere, like a Peter Pan possessed. His plan is to play all shots likely to be outside the reach of his less active partner. Mrs. Breach takes her stand at the mid-point of the back line, from where she smashes, volleys and lays about generally with great accuracy and force. Her returns miss the top of the net by half an inch, land at an opponent's feet, and rise with increased velocity to a height of about six inches. To the local fans these shots are known as "Mrs. Breach's babies."

Mrs. Breach is also an accomplished whist driver and a persistent, if not too agile, dancer. In fact she is a social success; and she never spoils the effect by exceeding her customary allowance: four pints, pale ale, per evening. It is true that her dislike of "port and lemon" always puzzles her fellow members; but we all have our little foibles and unaccountable aversions, and it would not be fair to criticize the matron too severely on this score.

Down the north-east face of the hill the path from the hospital winds among the trees and bushes, crosses a nullah which is watered by a babbling

3

brook, and ascends a grassy, flower-bespeckled bank, where it joins the Mall at the entrance to the East End married quarters. It is a pleasant path, cool and quiet, and the afternoon fatigue of the sweepers of the Indian Hospital Corps succeeds in keeping it clear of the dregs and debris deposited by the inhabitants of the adjacent married quarters and post-office.

Our post-master, Mr. Brikhbhan Chatterjee, is a Bengali, and leader of the local intelligentsia. Although not actually fat, he is inclined that way, and always looks as if he had just stepped out of a bath of olive oil. This lubricant effect is enhanced by a liberal use of brilliantine, which emits a powerful odour and ruins Mr. Chatterjee's coat collar. The coat is a sports garment—navy-blue flannel, patch pockets and numerous brass buttons which are not always polished and shining. He also wears a flowing white dhoti with an orange border, coral socks attached to magenta suspenders, and patent-leather pumps with butterfly bows.

There are two ways of approaching Mr. Chatterjee: The British or wrong, and the Bengali or right; and as, in Our Station, one is so dependent on His Majesty's mail, it is worth while to note the effect of each of these methods.

Adopt the foolish style —

"Oy—post-master—'ow much?"

"For registration?"

"Yes."

"Then I cannot accept. There are only twenty-one seals, whereas, according to 'Indian Post and Telegraph Guide,' section 5, sub-section xx (g), a package of synonymous dimensions must bear twenty-two seals."

"Blarst! Then I'll fetch it back with another seal."

"That will be *ultra vires*, since it is now 15.59 hours, and post-office closes at 16.00 hours."

Now try the wise way, thus:—

"*Ola, bhai*! I trust Mahatmaji and Punditji are in good health."

"Sir—'Tribune,' Muttra, announces they will be released to-morrow for purpose of hoisting national flag up the pole at High Court, Allahabad."

"I suppose the troops will give a general salute facing the pole."

"No doubt, sahib, they will provide colossal *tamasha*, but 'Tribune,' Muttra, preserves unwarranted silence on this matter."

"I should like to be there. And day after to-morrow we shall all embark at the Apollo Bunder no doubt."

"No, Your Honour, God forbid! We shall require safeguards for twenty years, after which, I hope, martial spirit of Bengali nation will take precedence once more."

"Ah!"

"Editorji 'Tribune,' Muttra, says——"

"By the way, would you very kindly register this package? I see it is past closing time."

"Sir, that is of no consequence; and will you give your humble servant

permission to affix a few more seals in accordance with certain dam rules relevant thereto? Otherwise Brikhbhan Chatterjee, babu, will be the broken egg in the omelette."

"May you become Post-Master General and Foreign Secretary, Indian Dominion Government, babuji!"

"May your servant's prayers exalt Your Honour's fortunes till they soar like our fire balloons on the last nights of the *Durga Pujah*!"

Choose which you prefer; but Bengali fashion pays.

The East End married quarters resemble those in the West End, except that they harbour a greater number of rats. In the fight against these rodents it is essential ever to bear in mind the principle that "the full power of any army can be exerted only when all its parts combine in action." On our side the parts consist of a countless horde of canines, sulphur bombs, "stickphast" and traps. These are opposed to mining, mobility, interior lines of communication and intimate knowledge of the ground; and we find that, whenever our co-operation is defective or our offensive weakens in any way, the initiative soon passes to the enemy. It is a fairly level contest and, on the whole, honours so far have been easy. Great expectations arose in higher circles when Milord formulated a scheme for introducing a colony of snakes into the area. It was known as the S.S. Plan. Unfortunately, before it had reached fruition it was given away by Corporal Register, the S.S.O.'s own clerk. As a result Milord had to face an angry anti-snake deputation, headed by the formidable Mrs. Dough: the order for snakes had to be cancelled at the last moment: and Corporal Register had to be relieved of any further responsibility for Mrs. Dough's welfare. Serjeant Dough suddenly appeared on the scene—the first time on record that a husband has been restored to his wife by serpent agency.

Speaking by and large, Our Station is a most respectable, well-behaved township. But, with so many wives in the hills and so many husbands in the plains, minor domestic contretemps of the above kind are quite frequent. Usually they take one of two forms: the laughable and the magnified. Those in the former category cure themselves and are forgotten as soon as fresh ones come to light. Those in the latter class give rise to wonder for periods of nine days each, and are seldom as serious as gossip desires them to be. Lumped together they furnish us with as much amusement and excitement as people at home derive from their Sunday newspapers.

It is curious that, on the married strength of 1 Bn. the Goomshire Regt., there are very few Englishwomen. After the War the battalion led a roving existence, from the Rhine to Ireland, and thence to India via some of our outlying possessions. This, in part, accounts for the choice of wives; and, for the rest, it may be that the mild English maid has been deterred by the foreign legion, the colonial contingent and the Irish brigade. One of the Englishwomen, on being asked if she had seen the film "Beau Geste," replied: "No; but I live it—down in the lines, you know."

No. 1 block, married quarters, is known as the International Settlement, and the eight women who preside therein are natives of Cadiz, Cologne, Coblenz, Wiesbaden, Lille, Louvain, Mauritius and Bermuda. The International Settlement contains the happiest, cleanest and quietest collection of families in Our Station; and yet, not content with its pride of place, it entered into a dangerous form of competition which nearly spoiled everything. It challenged the traditional supremacy of No. 2 block in a matter regarding which No. 2 block is exceedingly proud and extremely sensitive.

No. 2 block is the Irish reservation, and its undisputed claim to fame rests in its prolificity.

At the time in question No. 2 block was leading the rest of the battalion by two; so, when Mrs. Dubbin (*née* Schnitzelkopfer) and Mrs. Pipeclay (*née* Dupuytren) each had a baby in the early hours of the same morning, the scores became level. Although for the moment nothing untoward happened, Milord looked grave and talked about the calm before the storm, while Mary went about begging all and sundry to do nothing to upset the peace or besmirch the fair name of Our Station.

Tension and anxiety were becoming almost unbearable when, at the expiry of a week, Mrs. Cartridge (*née* Cafferty) saved the situation in true Irish fashion, and saved it handsomely too.

Mrs. Cartridge gave birth to triplets.

The International Settlement took the rebuff quite calmly; indeed it was rather relieved, than otherwise, to be deprived of a laurel which was threatening to become a fiery cross. No. 2 block openly rejoiced and boasted in public places—Private Cartridge excepted. In the enforced absence of Mrs. Cartridge, Private Cartridge became the saviour-hero of Our Station. Nevertheless, and despite an unlimited and gratuitous supply of small beer, Cartridge never rose to the occasion; in fact, he consistently declared that, so far as he was concerned, the contest was now devoid of all interest—that he had dropped out, definitely and permanently; and the more his admirers plied him with small beer, the more depressingly obstinate did he become.

However, that is but the fatuous pronouncement of a mere man. With such an encouraging lead, it is not to be supposed that the daughters of Erin will run the risk of a second setback. *Pace* Private Cartridge, interesting developments are not unlikely to take place in the near future.

Unfortunately the Goomshires were stationed in Ireland at the wrong time, and this must account for the fact that the Irish wives have turned out to be good, bad and indifferent in the proportions of 1, 2 and 1; and while Mrs. Cartridge's effort gained for her our heartfelt gratitude and warmest thanks, yet it will not be forgotten that it was a Cartridgean escapade which inspired a once-popular song in Our Station. I first heard this song at a Sergeants' Mess "smoker"—ladies not invited, windows

and doors closed and "Mum's the word, sir." The words were set to the tune of "Phil the Fluter's Ball" and the song, like its famous prototype, had six verses too many, and lines belonging to one verse were very apt to be interpolated in another. So I may be forgiven for only quoting the verse of which I am sure—number one, to wit:—

THE CARTRIDGE LINGERIE.

Have ye heard o'Mistress Cartridge who was Clara Cafferty?
Sure, the way she went for Mistress Slings née Margot Marquetrie—
O! the S.S.O., the doctor and the provost-sergeant bold
Constituted a committee for to hear the tale unfold.
Mistress Cartridge swore that all her underclothes,
In the sunshine hanging out to dry,
Had been pinched from underneath her very nose
By Mrs. Slings's khidmutgar, a cunning man and sly.
Then the doc. had a shock and the provost and the S.S.O.
Said: "Here's a go—in half a mo' we'll have to vet. the underclo.
"No—no—not at all—except 'tis from afar;
"Undies never were intended for a bloomin' khidmutgar."

The song goes on to relate how Mrs. Sling's khidmutgar was trapped into divesting himself of all his clothing, for the purpose of indulging in the annual hot bath, and when—as he thought—nobody was about. But he reckoned without Mrs. Cartridge.

What Mrs. Cartridge thought of it all is not dwelt upon—at least, not in any detail.

The last verse describes how, a month later, Mrs. Cartridge discovers the missing garments in the oven—where she herself had put them "to air"—and the concluding lines run thus:—

So the cam and the knicks and the vesty and the resty O!
Scented they of pasty and of tasty herring roe.
Baked potatoes and Beeton's congeries.
Were commingled in confusion in the Cartridge lingerie.

Are you tired of tales about the women? I hope not: I hope they interest you because, although the women do not appear on parade, their influence and conduct go a long way towards the making or marring of any unit. As an example, take the case of the Royal Caterpillar Corps, with its large proportion of wives from fair Midlothian. The R.C.C. is very efficient, smart and clean, but it is not too popular with the ruling classes. Instigated by its women, it is forever stirring up some minor trouble, flaunting a grievance or refusing to make bricks without straw — the greatest of all sins in the length and breadth of Hindustan.

Drink, desert or mutiny, but never refuse to make bricks without straw.

(*To be continued.*)

ENTERIC FEVERS, DYSENTERY, AND THE ROUTINE EXAMINATION OF MENIALS FOR THE CARRIER CONDITION.

A Circular Issued from the Office of D.M.S., India.

(*Continued from Vol. lvi., p. 441.*)

The bacteriological examinations in convalescence which have been required in the past appear to have been hardly worth the time and trouble, and in the new edition of Regulations for Medical Services, India, Appendix XIX, paragraph 19, macroscopic examinations of stools in convalescence have been substituted.

The number of bacilli of the dysentery group isolated from cases of diarrhœa is small, but, in view of their occasional isolation in the absence of mucus it would appear that the number of cases of diarrhœa due to these organisms is probably far greater than is realized. A very large number of the mild Flexner cases of dysentery in India commence as a simple diarrhœa for a day or two prior to the appearance of blood and mucus. If these cases reported sick immediately on the onset of the diarrhœa, and were treated at once as a routine with repeated doses of sodium sulphate for a few hours, it is probable that a large proportion of the cases would not progress to the state of blood and mucus, as the infecting bacillus would be washed out of the bowel before it had time to produce sufficiently severe inflammatory effects on the bowel wall.

In certain stations, orders have been in force in all units that every soldier or sepoy should report sick immediately on the onset of diarrhœa, and good results have been obtained. If similar orders were in force in all stations, particularly at the beginning of the dysentery season, many early cases might be caught and treated, and the further spread of the disease arrested.

From the annual reports and medical transactions of hospitals in 1929, it was apparent that in a few instances there still remained some confusion as to the differentiation between "dysentery and diarrhœa" as regards the diagnosis required for statistical purposes. Both these terms refer to a "clinical syndrome" and not to one disease in the strict sense of the term.

In most tropical schools the set of symptoms referred to as dysentery are those of "blood and mucus in the stools plus pain and tenesmus." In many mild Flexner infections, however, the pain and tenesmus may be slight or absent. For military statistical purposes, therefore, any case of looseness of the bowels without blood and mucus is considered as diarrhœa, and any case in which blood and mucus are present even to a slight extent is considered to be dysentery and should be diagnosed as such. It should be

unnecessary to state that where the *cause* is known, whether a dysentery bacillus or *E. histolytica*, a carcinoma of the rectum, or inflamed hæmorrhoids, the diagnosis should be given according to the known cause.

It is also not generally realized that the organisms capable of producing the clinical syndrome of dysentery are not restricted to the so-called dysentery group of bacilli. Similar symptoms may be caused by bacilli of the Salmonella group, i.e., *B. aertrycke*, and particularly *B. enteritidis* (Gaertner), which has been shown to be capable of giving rise to severe and protracted dysentery similar in every respect to that caused by *B. shiga*, *B. flexner*, *B. sonne*, etc. The treatment in all cases is the same, i.e., early, prompt and repeated administration of salines to wash out the infective bacillus, plus anti-dysenteric serum in sufficient quantity to counteract bacillary toxins. The earlier the serum is administered the better the result, and in the few cases in which bacilli other than those of the dysentery group are responsible its injection can do no harm. Experience has shown that the usual very mild case in adults clears up rapidly on saline treatment alone.

A number of deaths occur annually among children of military families from dysentery and acute enteritis. From the case sheets of some of these cases it is apparent that the illness of the child has frequently not been brought to the notice of a medical officer until twenty-four hours have elapsed from the onset of the disease, nor has the medical officer always appreciated the importance of early saline treatment, but has attempted palliative treatment with hydrarg. cum cret., sod. bicarb., and fractional doses of calomel, or a single small dose of castor-oil emulsion not repeated.

An article on this subject by Lieutenant-Colonel Green Armytage, I.M.S., has been recently circulated to all military hospitals and should be carefully perused by all medical officers, particularly as regards the lines of treatment laid down. It will be noted that the author stresses (1) the bacillary origin of practically all these enteritis cases in children ; (2) the necessity of getting rid of toxins or bacteria by saline treatment at once ; (3) alkalis to counteract the acidosis almost invariably present; (4) the replacement of fluid lost through dehydration by normal saline injected subcutaneously and intraperitoneally and given by the mouth. From a perusal of the case sheets of some of these cases it appears that the importance of these points, particularly the second and fourth, has not always been realized by medical officers.

A point of great importance is whether the pendulum in favour of a diagnosis of bacillary dysentery as opposed to amœbic infections has not swung too far in the direction of the former. If so, cases of undiagnosed amœbic infection showing indefinite exudates must be hidden among the clinical cases reported from the laboratories. For the purposes of statistical inquiry the percentage of these cases has been estimated at a maximum of fifteen. It is considered that this is probably too high an estimate, as such cases have not been treated with emetine, and cysts would normally

be expected to be present in the stools in convalescence. Forty-three such cases are recorded as occurring in 1929.

The large majority of the cases producing indefinite exudates are very mild (in the past largely diagnosed as diarrhœa), and clear up in a day or two with little treatment except a few doses of salts, but a frank amœbic dysentery seldom clears up quickly without emetine treatment. This is so much the case that, if a mild case showing a typical bacillary exudate does not clear up in two to four days with appropriate treatment by salines, and serum if necessary, the possibility of the infection being a mixed one should invariably be considered.

It is a common experience in all laboratories that the indefinite exudates to a large extent come from cases (*a*) *very* early in the attack before the inflammation has progressed to the stage of much blood and mucus, (*b*) late in the attack when the case is clearing up, (*c*) from specimens in which mucus has not been carefully selected for despatch to the laboratory.

It would be expected that if many amœbic infections were being untreated by emetine in the past five years during which the change in diagnosis has been steadily progressing, the incidence of hepatitis and tropical abscess would have increased. It has on the contrary remained at a practically constant figure for three years, and in 1929 there were twenty cases less than in 1928 among British troops, and eighteen less among Indian troops. From a perusal of the I.A.F.I.-1220, it would appear that of the ninety-two British cases, seventy-four were definitely amœbic in origin and were treated with emetine. The remainder stated to be due to alcohol, chill, etc., were treated by purgatives, etc., for a few days, and discharged from hospital. In nine of the seventy-four amœbic cases a definite diagnosis of tropical abscess was made. From the previous histories of these seventy-four cases as given on I.A.F.I.-1220 it appears that:—

Fifty (67·5 per cent) denied having a previous attack of dysentery or diarrhœa.

Twelve (16·2 per cent) gave a history of a previous admission for amœbic dysentery.

Seven (9·4 per cent), of whom three had not reported sick, gave a history of a previous attack or attacks of diarrhœa.

Two gave a doubtful history of dysentery, one as far back as 1910, and one stated he had had an attack in England prior to coming to India.

One had a previous admission for dysentery group.

In one *B. flexner* had been isolated during a previous attack.

In one bacillary exudate had been reported during a previous attack.

The two latter cases were probably cases of mixed infections, and the dysentery group case, probably an amœbic infection in which *E. histolytica* had not been discovered. The percentage of undiagnosed amœbic cases therefore appears small, but it is a fairly common experience in all laboratories that the nearer the hospital to the laboratory the more bacillary and amœbic cases are diagnosed. It is a reasonable presumption

therefore that a proportion of amœbic cases *are* being missed. The remedy must lie with the medical officer in charge of the case. If in stations in which a laboratory at close range is not available, medical officers in charge of cases examined fresh specimens from their own cases microscopically, and accepted *nothing as E. histolytica* unless it was really motile and contained red blood cells, however tempting the appearance of the cell under consideration might be, it would be impossible for a mistake to occur. Duplicate specimens sent to the laboratory, (*a*) on a slide, and (*b*) in glycerine and saline solution as laid down in Appendix XXI of Regulations for the Medical Services of the Army in India, 1930, along with a report stating that *E. histolytica*, motile and containing red blood-cells, had been observed would make assurance doubly sure. By examining fresh specimens medical officers would also become acquainted with the microscopic appearance of bacillary exudates.

The possibility of mixed infections should also be carefully looked for. It is possible such infections exist in from two per cent to as high as eight per cent of cases.

It should be noted that 67·5 per cent of the hepatitis cases gave no history of dysentery or diarrhœa prior to admission. This indicates that the extent of amœbiasis among the troops is possibly greater than is realized.

ANALYSIS OF 150 CASES OF AMŒBIC DYSENTERY, SYMPTOMATOLOGY, &C.

Abdominal pain or discomfort		Bowel symptoms		General symptoms	
Present in ..	..126	Diarrhœa ..	..114	Pyrexia ..	.. 13
Absent in ..	.. 24 cases	Alternating diarrhœa and constipation ..	.. 8	Hepatitis ..	.. 9
				Emaciation ..	.. 43
Generalized abdominal pain	70	Constipation ..	.. 11		
Epigastric discomfort ..	19	Normal regularity of motions	.. 17		
Gall bladder area ,, ..	2	Flatulence ..	.. 37		
Liver area ,, ..	9	Tenesmus ..	.. 34		
Right shoulder area ,, ..	2	Blood and mucus in stools	71		
Gastric, localized ..	3	Mucus only in stools ..	18		
Duodenal, localized ..	1				
Transverse colon	1				
Coecal and appendicular ..	7				
Sigmoid and descending colon	10				
Lumbar localized.. ..	2				

Manson Bahr and Tait (*Lancet*, November 16, 1929) give an interesting analysis of 150 cases of intestinal amœbiasis. A table analysing the symptomatology of these cases is given above. The number of the cases presenting abdominal symptoms is high, but it seems from the text that the cases were largely brought to notice *because* of the presence of these symptoms. In a country such as India it is conceivable that the number without symptoms, although infected, may exceed those with symptoms. The moral is that apart from cases with actual diarrhœa

individuals with vague abdominal pains, flatulence, constipation, etc., should have their stools examined to exclude the presence of *E. histolytica* cysts.

In reporting on the previous history of cases with amœbic hepatitis on I.A.F.I.-1220, a note should be made on the card as to the presence or absence of these aberrant symptoms previous to admission. In every hepatitis case the presence or absence of *E. histolytica* vegetative forms or cysts during the patient's stay in hospital should also be recorded.

SECTION III.—*Routine Laboratory Examination of Menials.*

In this section the difficulties of the carrier problem are briefly discussed, also the lines on which an improvement in the present unsatisfactory system of examinations may be possible. It should be noted that these suggestions will be embodied in an amendment to the Regulations for the Medical Services of the Army in India, which will be the authority for carrying out such examinations in future. The present circular is intended to be purely explanatory in nature.

1. *Enteric Group of Fevers.*

15,922 menials were examined for the presence of the carrier condition in 1929, 3,624 more than in 1928. The total laboratory examinations reached the high figure of 43,317. It will be realized that such a large number of examinations entails much time and labour on the laboratory staff, and a great expenditure on laboratory media.

The positive results obtained are in no way in proportion to either the labour entailed or the expense involved.

In both 1928 and 1929 the total number of carriers of enteric group bacilli discovered was twelve, nearly all being carriers of *B. typhosus.* From figures quoted by Topley the percentage of carriers of enteric group bacilli in a European population is not less than 0·4 and in India the percentage must be at least as high, and probably is much greater.

The reasons why a greater number are not discovered are probably: (1) The intermittency of active periods in the carrier condition, i.e., of those periods during which large numbers of bacilli are passed in the stools; (2) the arrangements for collection of specimens of fæces and despatch to the laboratory being defective in hospitals; (3) insufficient laboratory examinations per case, aggravated by a custom in certain laboratories until recently of plating out specimens from two or more cases on one plate of medium, with a view to economy of media and glassware.

In regard to the above it is worth noting that six of the twelve carriers detected in 1929 were discovered in the District Laboratory, Bangalore, where a very well organized scheme for carrying out these examinations was in force throughout the year. Two courses appear open for future action:—

(A) To abolish all carrier examinations either prior to or after enrolment or employment, unless on the occurrence of a case or cases of enteric fever.

(B) To cut down the number of individuals examined, improve the organization for sending fresh specimens to laboratories where it is defective, and increase the number of examinations per menial.

(A) is considered to be a confession of complete failure. Such a passive attitude is against the teachings and general experience of all health workers in the tropics. In the event of a cook enrolled as a Class I follower giving rise to a serious epidemic of typhoid and possibly some deaths, the fact that bacteriological examinations prior to enrolment had been omitted would be considered a serious case of neglect, not only by the general public but also by most medical authorities.

(B) would appear to offer the greater chance of success. It is therefore considered (1) that carrier examinations should be restricted to cooks, bhistis, dairymen and bakers, in the main, thus exempting from examination the floating population of cooks' mates, masalchis, etc., who owing to constant changes comprise a large proportion of the menials to be examined. It is realized that in theory these latter individuals are a possible source of danger, but practical experience in the past has not proved them to be responsible for any of the outbreaks of the enteric fevers that have occurred.

As regards menials employed by contractors in regimental institutes, supper bars, etc., it is considered that in addition to the cooks, the khidmatgar class who may be employed in handling much uncooked food (cakes, etc.) should also be examined.

Beyond the above, the necessity for laboratory examinations of other menials may be left to the discretion of A.Ds.M.S. of Districts, who it is hoped will realize the necessity of restricting the numbers of individuals belonging to classes other than those specified above to the absolute minimum. It is also considered that once an individual has been passed as "fit" he need not be examined again, unless suspected of being connected with the occurrence of a case of enteric group, or of having suffered from some illness of doubtful nature. This should materially reduce the number of examinations carried out annually, but is considered to be only in the nature of an experiment.

(2) That arrangements for the collection of specimens and their despatch to laboratories in such a manner as to offer the best chance of a positive result must be carried out under local arrangements. The responsibility for ensuring that a proper organization exists must rest finally with the O.C. hospital concerned, as without his active co-operation and close supervision of his subordinate staff in carrying out instructions better results can never be expected.

The points requiring close attention are :—

(1) That specimens from loose stools only are sent to the laboratory; mag. sulph. administered in the early morning suffices as a rule for this purpose. It should also be noted that three grains of calomel on the

evening prior to the administration of the early morning dose of salts have been found useful in procuring specimens for carrier examination.

(2) That wherever possible the specimens should be passed in a latrine in close proximity to the laboratory, and the collection of the specimen supervised by the laboratory sweeper. This method is in force in certain stations at present, and probably accounts for the good results obtained in the District Laboratory at Bangalore.

Where for the time being this method is impossible a Sub-Assistant Surgeon, preferably one of those who have been given a short course in a District or Brigade laboratory, should be detailed by the O.C., I.M.H., to supervise the collection of specimens in glycerine and saline solution and to ensure prompt despatch to the laboratory by post or otherwise. In very few hospitals is attention paid at present to the necessity for using *neutral* glycerine and saline solution. Certain district laboratories now issue this solution fortnightly to hospitals after accurately standardizing the solution, and this method has led to good positive results being obtained from dysentery cases in hospitals located in outstations.

A short description of the class of individual included in the six carriers detected in the District Laboratory, Bangalore, is included as a matter of interest.

(1) *Sepoy.—B. typhosus*; recovered once from his fæces during convalescent examinations after an attack of bacillary dysentery.

(2) *Barman.—B. typhosus*; during routine examinations prior to employment.

(3) *Sepoy.—B. typhosus*; during examinations carried out while undergoing training in cookery.

(4) *Khidmatgar.—B. typhosus*; in restaurant, convalescent after an attack of fever, which probably was typhoid fever.

(5) *Dairyman.—B. typhosus*; has been employed in a Government dairy for three weeks.

(6) *Cook.—B. typhosus*; employed in the general cookhouse of the British Military Hospital, Bangalore.

No cases of typhoid fever could be traced to any of these carriers.

The detection of the two sepoy carriers is worthy of note, and in this connection attention is redirected to the notes in Section I of this circular regarding the importance of the abortive case of typhoid who has either been misdiagnosed, or failed to report sick, and the ambulant case, as probably being more dangerous for a short period after inspection than the chronic carrier, who may pass *B. typhosus* in his stools in sufficient numbers to be dangerous at very infrequent intervals, if at all.

2. *Dysentery Carriers.*

Bacillary.—Dysentery bacilli were isolated in fifty-one cases. In many of these mucus was present at the time of examination. A large number of these carriers are bound to be missed, as it has been shown by Cunningham that fifteen to twenty per cent of the menial class of Indians

suffer from *latent* bacillary dysentery and at infrequent intervals a little blood and mucus are found in the stools for a day or two but with little or no constitutional effects. Unless the period of examination coincides with one of these relapses the likelihood of a positive result is small. Little reliance can therefore be placed on bacteriological examinations prior to enrolment owing to the restricted period over which they have to be carried out. As, however, the individual responsible for an outbreak is usually found to be passing blood and mucus, more attention should be paid to the *macroscopic* examinations of stools of kitchen staffs, etc., over a period of a few days, than to the bacteriological examinations of fæces in the absence of mucus, should an outbreak of bacillary dysentery occur in a unit.

Appendix XIX of Regulations for the Medical Services of the Army in India lays down that no one who has suffered from enteric fever or dysentery should be employed in a cookhouse. It is clearly realized that in actual practice this is impossible to carry out in its literal meaning, as probably all Indians have suffered from dysentery at some time or other.

Many suggestions have been received stating that this regulation entails a certain amount of hardship and is illogical, but when the authors have been faced with the query, "Would you permit a man you know to have recently suffered from dysentery or enteric to cook for yourself and family or a large body of troops, and would you issue a regulation for the world to read to this effect?" no helpful suggestions have been received. In this respect attention is drawn to the preface of the Regulations for the Medical Services in India. "Officers are expected to interpret the regulations contained in this volume reasonably and intelligently, with due regard to the interest of the Service."

It is considered that there is more danger from a food handler whom we know to have suffered from a recent attack of enteric fever or dysentery than from an individual who *may* have suffered from a hypothetical attack in childhood.

Amœbic Dysentery.—544 menials were found to be carrying *E. histolytica* cysts in 1929. The percentage found positive undoubtedly varies to some extent with the time and trouble given to these examinations, although the population is almost certainly more heavily infected in some areas than others, e.g.:—

Laboratory	Percentage positive
Bangalore	8·06
Bareilly	9·3
Razmak	5·6
Poona	5·3
Secunderabad	5·05
Lahore	3·29
Meerut	1·4
Lucknow	2·3

As not more than three examinations have been carried out per menial it is probable that a fair percentage of amœbic carriers also is missed. The average percentage of the population infected is probably at least ten to fifteen, and may be higher. If this is so, it would appear that the average cyst carrier employed in a cookhouse is not a grave source

of danger. It was pointed out by one D.A.D.P. in the annual report of 1929, that during the year in his station only ten cases of frank amœbic dysentery occurred, and yet ninety-four carriers of *E. histolytica* were discovered, and that therefore it must take at least nine carriers to produce one case of dysentery.

That acute amœbic dysentery cases form roughly fifteen to twenty per cent of the total dysentery cases in India has been proved conclusively during the past five years by workers of experience in all areas; but the extent of "amœbiasis" apart from dysentery among British troops and families and among Indian troops which may give rise to no appreciable symptoms, or to aberrant abdominal symptoms, or to amœbic hepatitis, is a matter on which we have little accurate information and which appears definitely to require investigation.

It is probable that the *E. histolytica* cyst is really transmitted with greater difficulty from a carrier than a dysentery bacillus. The *E. histolytica* cyst dies immediately when dry, and therefore is unlikely to be carried to any extent by hand, and can never be carried in dust in India, in spite of statements to the contrary in textbooks, probably copied from edition to edition without real consideration.

In addition, it must be present in fæces in much fewer numbers in the average carrier than is *B. dysenteriæ* Flexner in the mucus of a case of acute or latent bacillary dysentery and, therefore, offers less opportunity to the fly as an intermediate host.

It has been noted also that on the occurrence of cases of amœbic dysentery in a household, the menial who appeared to be connected with the origin of the case or cases was usually found to be passing large numbers of cysts in his stools, but that menials in whom, after careful search, only one or two cysts were discovered, might cook for years and produce apparently few harmful results. The intensity of infection in the carrier may therefore be of importance in the propagation of the disease.

Summary.

From the examination of the enteric and dysentery groups and the examinations of menials with a view to excluding carriers of these diseases, the following points arise:—

(1) For various reasons our methods of excluding carriers of enteric group fevers appear to be inefficient, and can only be improved by decreasing the total number of individuals examined, and increasing the number of examinations per individual.

(2) From a study of the various small outbreaks of enteric group fevers, the negative results of laboratory examinations among the kitchen staffs concerned, and the increasing number of abortive cases of typhoid fever being brought to light, it may be that the examination of individuals who have suffered from short pyrexia, or simply mild indisposition about the same time and in the same unit, may yield better results than examinations restricted to kitchen staffs alone.

(3) Our examinations to exclude carriers of dysentery bacilli are also inefficient, although slightly better than in the case of the enteric group, and macroscopic examinations rather than bacteriological in the case of an outbreak of bacillary dysentery in a unit applied to kitchen staffs, khidmatgars, etc., will probably give better results, and be easier to carry out efficiently.

(4) Amœbic appears to be less easily spread than bacillary dysentery, but we have few facts to go upon as regards the extent and spread of "amœbiasis" apart from dysentery, and information on this subject from experienced and reliable microscopists and physicians working in co-operation is badly needed.

(5) In view of the tendency to relapse in latent bacillary dysentery, and our deficient knowledge as regards the spread of amœbiasis, it is impossible to allow an individual whom we *know* to have suffered recently from bacillary dysentery, or to be a carrier of *E. histolytica*, to continue cooking for troops.

Practical Application.

(1) *Enrolled Followers Class I.*—India Army Order No. 597 of 1928, sanctions subsistence allowance to enrolled Class I followers, *cooks, bhistis, bakers*, for a period not exceeding ten days. It is essential therefore that the report on the last examination should reach the recruiting authorities on the ninth day. In practice this means that more than three bacteriological and three microscopical examinations cannot be carried out prior to enrolment. In future therefore all recruits for these classes will have the above examinations carried out prior to enrolment, and during the first year of their service a bacteriological examination will be made once a month, after which no further examinations will be carried out during their service, unless they are suspected to be connected with the origin of an outbreak of disease. It is possible that by this means the intermittency of the infective period may be overcome to some extent.

Examinations after enrolment will be "bacteriological" only.

(2) *Unenrolled Menials* (dairymen and khidmatgars).—Dairymen who come in contact with milking processes, and contractors' khidmatgars in coffee bars, restaurants, etc., are the only other classes which will be examined in future, and being a more floating population than the above, it may be impossible to carry out monthly examinations.

In future these classes will be given three bacteriological and three microscopical examinations prior to employment, and then three bacteriological examinations at weekly intervals, after which no further examinations will be carried out unless they are suspected of being carriers.

(3) Unless they are suspected of being carriers no examination will be made of any other class than the above (e.g., of the dish washers, cooks' mates, tea boys, hawkers and so on) except an A.D.M.S. particularly wishes it to be done as an experimental measure. Should it be proved in the future that they are responsible for outbreaks to any serious extent, the procedure will have to be modified. At present no such proof exists.

REPORT ON A SERIES OF CASES OF DIPHTHERIA AT THE SCHOOL OF ELECTRIC LIGHTING, GOSPORT.

By Major K. COMYN,
Royal Army Medical Corps.

The School consisted of Nos. 22 and 4 Companies, R.E., at Fort Monckton and Haslar Barracks, respectively. There were no boys in No. 4 Company, and as no case of diphtheria occurred in this unit, and the two Companies did not work together, No. 22 Company at Fort Monckton alone forms the subject of this report. No. 22 Company consisted of 3 officers, 47 N.C.O's. and men of the administrative and instructors' staff and 206 boys. The number of boys varied from time to time, but during the period under review no new boys were admitted, but six left the unit. Their ages were from 14 to 17 years.

The first two cases of diphtheria occurred on December 11 and 14, 1927, and, as a result of routine swabbing of immediate contacts, two other boys were found to be positive to K.L.B., and were admitted to hospital as carriers. From December 11, 1927, to January 30, 1928, six clinical cases of diphtheria and five contacts, all with positive throat swabs, were admitted to hospital.

During the latter part of this period Colonel A. W. Bewley, S.M.O., Gosport, who was in medical charge of the School, considered the question of immunizing the susceptibles, and with that end in view he Schick-tested 203 boys between January 13-20 and found seventy Schick-positive.

It was then decided to segregate all the Schick-positive boys in Fort Southwick, situated on Portsdown Hill, fifteen miles from the School of Electric Lighting, and immunize them. The segregation took place on February 4.

It was also decided that every individual of the unit, whether Schick-positive or Schick-negative, and the staff should be bacteriologically examined in order to eliminate carriers. Major W. W. Pratt from the Royal Victoria Hospital, Netley, assumed control of the swabbing and bacteriological investigations. It was decided that virulence tests were henceforth to be done on all individuals with positive swabs, and any non-virulent carriers were to be ignored and only virulent ones to be returned as carriers. Diphtheria cases with clinical symptoms were to have virulence tests done where possible, but were diagnosed on clinical and bacteriological grounds. Major Pratt completed the swabbings of 198 boys, and of the administrative staff, between February 3 and March 6. As a result of this twenty-four boys were found to be positive to K.L.B. Virulence tests were done on all these and six were found to be virulent. Of these 6 virulent carriers, 1 was Schick-positive and 5 were Schick-negative.

Of the original 206 boys, 8 were not bacteriologically examined, 5 had left the unit and 3 were in hospital. Of the latter, 1 was afterwards invalided and 2 were suffering from diphtheria; these 2 were subsequently examined bacteriologically at the Royal Naval Hospital, Haslar, at weekly intervals during six consecutive weeks and found negative. An interesting fact with regard to these bacteriological findings is that of 24 boys found positive, in 18 the nose only was infected, in 4 both the throat and the nose, and in 2 the throat only. Of the 6 virulent carriers, 4 were nasal, 1 both nose and throat and 1 throat only. These results emphasize the importance of taking nasal swabs in all suspected cases or contacts.

The immunization of susceptibles segregated in Fort Southwick was started on March 22 with Burroughs Wellcome's toxoid-antitoxin mixture. Three doses, each of one cubic centimetre were injected subcutaneously into the arm at weekly intervals.

Of the original seventy Schick-positive boys, sixty-four were immunized. No ill-effects were recorded beyond slight giddiness in one case a few hours after injection. No boy had to give up either amusement or duty. The six who were not immunized included four in hospital with diphtheria, one contact who had been in hospital and had received antitoxin, and one carrier in hospital. All these six were subsequently Schick-tested and found to be negative.

Subsequent to the segregation of the Schick-positives on February 4, three cases of diphtheria occurred among the Schick-negatives at Fort Monckton, one on February 24, one on March 17, and the third on March 31; but no cases occurred amongst the Schick-positives at Fort Southwick.

The 9 cases of diphtheria, except 1 which had been transferred to another unit, the 6 virulent carriers and the 5 early carriers who had not had virulence tests done—19 in all—were bacteriologically examined, both nasally and orally, at the Royal Naval Hospital, Haslar, for six consecutive weeks at weekly intervals during April and May and all were found to be negative.

The sixty-four Schick-positive cases which had been immunized were again Schick-tested two months after the last dose of toxoid-antitoxin mixture, and all were found to be Schick-negative. The four diphtheria cases which were originally Schick-positive were again tested in June and found Schick-negative. This result may have been due to active immunity acquired from the disease or to passive immunity acquired from antitoxin.

One diphtheria case which had not been previously tested was now done and was found to be Schick-negative, as also were one suspect case which had received antitoxin and one virulent carrier originally Schick-positive.

Thus by the end of June, out of 206 boys originally in the unit, 5 had left or had been transferred to other units and 1 had been invalided. The 200 remaining were all Schick-negative and had all been bacteriologically

examined both nasally and orally and found to be negative to K.L.B. No further case had occurred after March 31—three months.

The boys in segregation at Port Southwick were therefore returned to the remainder of the unit in Fort Monckton.

Investigation as to Possible Source of Infection.

A careful scrutiny of the health reports from the Medical Officer of Health, Gosport, for the two months prior to the outbreak revealed that there was very little diphtheria in the civil population at Gosport—on an average only one case a week was reported. The outbreak started before Christmas leave, and it seems probable, therefore, that infection occurred within the unit, and was not contracted from civilian sources.

The canteen and recreation rooms were inspected; their staff was a small one and free from suspicion. The washing up of cups and glasses, etc., was satisfactorily done with ample boiling water. The rooms and huts occupied by the boys were well ventilated, not overcrowded, and the beds were well spaced.

When a case occurred during the outbreak, all the boys in the same hut or room were segregated in a building kept for the purpose for twenty-four to forty-eight hours while their hut or room was thoroughly disinfected. The boys then returned to their own hut or room. Boys from one hut were not mixed with those of any other during the process of disinfection.

There was no special incidence in these cases in any particular room. The first case occurred in No. 5 room on December 11, 1927, and the two boys next to him were found to be positive to K.L.B. No other case occurred in this room.

The next case was from No. 3 hut on December 14, 1927. Two other clinical cases and one virulent carrier came from this hut, but twenty or more days elapsed between each, i.e., a diphtheria case on January 25, 1928, a carrier on February 16, 1928, and a case on March 31, 1928.

The third case occurred in hut No. 2, and the two boys next to him were both found to be positive K.L.B. One more case occurred in this hut on February 24, 1928, i.e., after an interval of over six weeks.

Two cases occurred on January 24, 1928, in hut No. 6. No further cases came from here.

There were then two carriers from No. 5 hut on January 30, 1928, and February 7, 1928, and a later carrier from the same hut on March 30, 1928. There was one carrier from No. 1 room on February 28, 1928, one carrier from No. 8 room on March 1, 1928, one carrier from No. 1 hut on March 7, 1928, and one case from No. 9 room on March 17, 1928.

Thus it seems well-nigh impossible to trace the source of infection, though the responsibility must inevitably be thrown upon one or more virulent carriers within the unit, but whether the infection was passed from one to another in huts, dining room, recreation room or school rooms, it is difficult to determine.

TABLE.

DIPHTHERIA OUTBREAK—SCHOOL OF ELECTRIC LIGHTING.

Original hut or room	Barracks	Case	First Schick test	Diagnosis	Date of onset	Virulence	Second Schick test
5 room	Fort Monckton	D 1	Not done	Diphtheria	11.12.27	Not tested	Negative
3 hut	,, ,,	D 2	Not done	Diphtheria	14.12.27	,,	Left Unit
5 room	,, ,,	C 1	Negative	Carrier	15.12.27	,,	
5 room	,, ,,	C 2	Negative	Carrier	15.12.27	,,	
2 hut	,, ,,	D 3	Positive	Diphtheria	3.1.28	,,	Negative
2 hut	,, ,,	C 3	Negative	Carrier	6.1.28	,,	
2 hut	,, ,,	C 4	Negative	Carrier	6.1.28	,,	
6 hut	,, ,,	D 4	Positive	Diphtheria	24.1.28	,,	Negative
6 hut	,, ,,	D 5	Positive	Diphtheria	24.1.28	,,	Negative
3 hut	,, ,,	D 6	Positive	Diphtheria	25.1.28	,,	Negative
5 hut	,, ,,	C 5	Negative	Carrier	30.1.28	,,	
*5 hut	Fort Southwick	VC 1	Positive	Carrier	7.2.28	Virulent	Negative
3 hut	Fort Monckton	VC 2	Negative	Carrier	16.2.28	Virulent	
2 hut	,, ,,	D 7	Negative	Diphtheria	24.2.28	Not tested	
1 room	,, ,,	VC 3	Negative	Carrier	28.2.28	Virulent	
8 room	,, ,,	VC 4	Negative	Carrier	1.3.28	,,	
1 hut	,, ,,	VC 5	Negative	Carrier	7.3.28	,,	
9 room	,, ,,	D 8	Negative	Diphtheria	17.3.28	Not tested	
5 hut	,, ,,	VC 6	Negative	Carrier	30.3.28	Virulent	
3 hut	,, ,,	D 9	Negative	Diphtheria	31.3.28	Not tested	

* Prior to going to Fort Southwick.

D = Diphtheria case.
C = Carrier, virulence not tested.
VC = Virulent carrier.

Summary.

(1) Between December 11, 1927, and March 31, 1928, three and a half months, there were 9 clinical cases of diphtheria, 6 virulent carriers and 5 contacts returned as carriers in whom the virulence test was not done.

(2) 203 boys were Schick-tested and 70 found Schick-positive and 133 Schick-negative, i.e., 34·4 per cent Schick-positive.

(3) 198 boys were swabbed bacteriologically and in 24 K.L.B. were found. In the majority, 18, the bacilli were found only in the nose, in 2 in the throat only, and in 4 in both the throat and the nose.

(4) 64 boys Schick-positive were immunized with toxoid-antitoxin with no ill-effects. Two months later these were all Schick-negative.

(5) Of a total of 9 clinical cases, 4 were Schick-positive, 3 Schick-negative and 2 were not tested prior to the disease. Of these the four positives and one of those not previously tested were found to have become negative when tested subsequently—similarly one suspected case which received antitoxin became Schick-negative. The other case that had not been tested left the unit before it could be done.

Conclusions.

(1) That from the end of December, at least, the source of infection was within the unit.

(2) That routine swabbing of immediate contacts only is useless in such a community.

(3) Swabbing is useless unless the nose as well as the throat is carefully swabbed.

(4) Only virulent carriers need be considered.

(5) Immunization with toxoid-antitoxin is simple, apparently effective, and without ill-effects.

(6) That though cases and carriers were carefully spotted out both chronologically and topographically, it was impossible to define accurately the source of infection. Therefore it was considered that nothing short of complete bacteriological examination of the whole unit, with consequent elimination of carriers, would suffice to stop the outbreak. Immunization of Schick-positives alone would not have sufficed inasmuch as 3 cases of diphtheria out of 9 were Schick-negative; and of 6 virulent carriers 1 was Schick-positive. This suggests that there are degrees of immunity which will give a negative Schick reaction, but which are not adequate to protect against the disease.

(7) Taking into consideration the period of incubation in diphtheria and the time taken in isolating a pure culture and doing virulence tests in carriers, it may be presumed that the source of infection was eliminated by the end of the third week in March. The last carrier was sent to hospital on March 30 as a result of bacteriological examination and virulence tests, and the last diphtheria case was admitted on March 31.

Editorial.

A STUDY IN NUTRITION.

A KNOWLEDGE of normal standard diets at different ages and under different conditions of work and environment is of great practical importance to those responsible for the feeding of communities, whether civil or military. This is especially the case when supplies of food may be limited by a national emergency, such as the late war; it is then essential to know the least amount of food which will be necessary, not only for the military forces but for the civilian population to carry on the necessary work without danger to health.

Special researches carried out during the war by Professor Cathcart, Sir Leonard Hill and Professor Plimmer for the War Office enabled the military authorities to fix diets for soldiers and munition workers. But at that time very little was known about the diets normally used by various classes of the general population under different conditions of work and environment.

The working figures of the assessments made for the population under military control were usually based on the investigations of Atwater carried out in America, and until Professor Plimmer made his analyses of English foods at the Royal Army Medical College in 1917 the determinations of the amounts of protein, fat, and carbohydrate in the different diets were based on figures given by Atwater.

Since the war numerous observations have been carried out on groups of men at one economic level, but few studies have been made of the diets normally used by English people.

With the object of obtaining more accurate knowledge of these diets the Medical Research Council deputed Professor Cathcart to supervise an investigation of the dietetic habits of a section of the population. A vertical section of the population of St. Andrews was chosen so that it might include both rich and poor.

In an investigation of family diets it is necessary to determine the man value of the various members of the family. Atwater and Lusk have both given certain values, but Cathcart and his co-workers thought it advisable to make a combination of both scales and adopted the following values: man, 1·00; woman, 0·83; boy 14 up, 1·00; girl 14 up, 0·83; child 12-14, 0·9; child 10-12, 0·8; child 8-10, 0·70; child 6-8, 0·60; child 3-6, 0 50; child 2-3, 0·40; child 1-2, 0·30; child 0-1, 0·20. They have placed the scales at a higher level than those of Atwater and Lusk, so that at the age group of 12-14 they are practically midway between the adult values for the mother and father. They were tempted to give this age

group an even higher value as their observations led them to think that children at or about puberty eat more than their fathers, especially when this parent does not belong to the manual working class. But as a large proportion of the population investigated belonged to the working class, they adhered to the more common practice of assuming that the male parent was the main consumer. The validity of the family co-efficient method of assessing the need of a family has been questioned by numerous competent observers. Cathcart and his co-workers believe that their results accurately represent the distribution in the families studied, though they admit that "it may eventually be found necessary to have two scales—one for families where the father does manual work and the other where the father is otherwise employed. Or, alternatively, that all families be classed on an arbitrary 2,500 cal. scale, and that in the case of the manual workers a special addition be made to the male parent's allowance."

The studies of families by Cathcart were carried out over seven days, and this introduced a difficulty, as on some days a member of the family might be absent and on other days visitors might be at the house for one or more meals. Full cognizance had to be taken of meals missed and extra participants. Repeated observations showed that in the average household the food was fairly distributed in three meals—breakfast, dinner and tea. In some households both supper and tea were taken, and the average distribution was two-thirds of the value to the tea and one-third to the supper, in other households this distribution was reversed. In this way allowances were made for meals missed and extra meals consumed. As a consequence the family man value and the diet man value were not necessarily the same, due to the meals missed or to the presence of visitors.

There were investigated in the course of the study 154 families comprising in all 745 persons, with a family man value of 3·37 and a diet man value of 3·51. These formed one-thirteenth of the total populations of St. Andrews, a rural town and practically devoid of any industrial element.

In making the computation of the composition and energy value of the various foodstuffs Plimmer's analytical data and special analyses made in the Physiological Laboratory, Glasgow University, were used.

The following table gives the results of the present study and for comparison the standard diets of Voit and Rubner.

	Protein		Fat		Carbohydrate		Calories
	Grammes	Per cent Total Calories	Grammes	Per cent Total Calories	Grammes	Per cent Total Calories	
Present study	89	11	119	35	411	54	3,119
Voit (moderate work)	118	16	56	17	500	67	3,055
Rubner (moderate work)	127	17	52	16	509	67	2,868

It will be seen that in the family diets there is a much greater amount of fat and much less protein than in the standard diets of Voit and Rubner. These results obtained from the investigation of St. Andrews family diets also agree very closely with the data collected by Dunluce and Greenwood in their research on the dietaries of munition workers. They found that about 37 per cent of the total calories were obtained from the fat in the diet and about 14 per cent from the proteins.

Even in the case of the relatively poorly paid workers, like agricultural labourers, the protein content of the diet tends to be low, and the fat content, as compared with the figures of Voit and Rubner, fairly high. Dunluce and Greenwood found that in the case of the agricultural labourers in the northern, midland, eastern and southern counties the calories from fat varied between 21·4 and 28·8 per cent of the total calories, while those from protein varied between 9·9 and 10·8 per cent. In twenty-seven studies of diets in the United States it was also found that the percentage of calories obtained from the fat was about 34·2.

The quantity and the quality of food consumed in a household depend largely on the income, and Cathcart arranged his families in five groups according to variations in the weekly income: (i) Up to £2 10s.; (ii) over £2 10s. and up to £3 10s.; (iii) over £3 10s. and up to £5; (iv) over £5 and up to £10; (v) over £10. As regards the protein intake it was found that although the amount consumed per man per day was lowest with the smallest income and highest with the largest and the amounts for the intermediate incomes were about the same, the percentage of energy derived from protein was practically identical, about 11 per cent. in all the five groups. The intake of carbohydrates was astonishingly similar in all the five groups, although the percentage of calories derived from carbohydrates was definitely higher with the smallest income. The divergence in value is due to the fat content, the consumption rising from 93·5 g. in Group I, with the smallest income, to 156·8 g. in Group V, with an income over £10 per week. It is generally believed that with a rising income there is an increased tendency to purchase foods richer in protein, like butcher's meat, with sometimes a decrease in the amount of starchy food consumed. The Glasgow studies showed this to be true even in the case of the relatively poor. With a weekly income per man of less than 8s. the protein was 64·1 g., and the carbohydrate 380·4 g.; when, however, the income was over 8s. the protein was 72·9 g., and the carbohydrate 352·5 g. But there is also evidence to show that with a rising income more is spent in fat-containing foodstuffs; there is a greater rise in the fat content than in the protein content, although this also rises.

The tendency to purchase fat is not peculiar to the St. Andrews population. Essex labourers with an income per man of 8s. consume 69·0 g. of fat, while miners with an income of 12s. consume 97·7 g. of fat. The same fact emerges in McCay's studies of Bengali families; cultivators consumed only 10 g. of fat, while middle-class families consumed from 20 to 35 g., and well-to-do families 47 g.

The craving for fat was a marked feature during the shortage of food in the Great War.

The St. Andrews researches did not show that there was any lavish consumption on the part of the well-to-do, but naturally their intake was higher than that of the households with the lowest income. The remarkable difference was the amount spent per man on food and the calorie return for the expenditure. In Group I the expenditure on food per man was only 8s. 11d.; in Groups II, III and IV there was a steady rise in the expenditure, culminating in £1 per man in Group V. The calorie return in Group I was, however, 187 per penny, but in Group V it was only 105. In Groups I and II the percentage of the total income spent on food was approximately sixty-six per cent and fifty-three per cent, and in Group IV and V probably about forty-five per cent.

Reviewing their studies of 154 families, Cathcart and his co-workers state that from the financial aspect two facts emerge most clearly. "First, that with a rising expenditure, or income, there is not only a rise in the total calories ingested, but there is even a more marked rise in the consumption of fat. Secondly, there is also a definite rise in protein intake which runs parallel with the rise in total calories. The percentage of the total calories from protein sources remains wonderfully constant at all levels, and, moreover, this value is quite definitely below that which was commonly assumed to rule."

The nature of the diets according to occupation was then studied, and for this purpose the families were divided into four groups: (I) sedentary; (II) semi-manual; (III) manual; (IV) unemployed.

The manual Group III included labourers, factory workers, stokers, bricklayers, blacksmiths, masons, motor mechanics, etc. The diet per man per day in this group was found to contain 83·2 g. of protein, 111·1 g. of fat, and 421·3 g. carbohydrate, equivalent to 3,095 calories. The expenditure on food weekly was 10s. 9d. per man, and 173·4 calories per penny were obtained. Cathcart states that the diet in Group III agrees as to total energy content almost exactly with the value obtained by the same method of deterination in previous studies. Moreover, as regards the component parts, the balance struck between the various proximate principles is good and might be accepted as a diet of model composition for this type of population.

In Groups I and II the calories in the diet are increased to 3,333 and 3,279 respectively, there is also a large consumption of fat, viz., 140·4 g. and 129·8 g. The intake of the sedentary worker is somewhat higher than the semi-manual class, although the return per penny spent on food is greater in the latter class.

If 3,095 calories of food are sufficient for the manual worker, then 3,333 calories of food must be too much for the requirements of the sedentary worker. The difference of about 200 calories must be utilized or stored. Now, Cathcart states that there is no evidence of obesity in this particular section of the population. The 200 calories represent about twenty-one to

twenty-two kilogrammetres of work or about one-fifth of the average daily expenditure of energy of the average manual worker. It is questionable whether the average sendentary worker expends this amount of energy in unproductive work; hence the food must either be stored or metabolized in some other way. Since there is no evidence of storage, it is suggested that there must be increased metabolism associated with the increased ingestion of protein. Rubner calls this "secondary dynamic action." But the excess of protein is only about six grammes, and this amount would probably not be sufficient to account for the 200 calories ingested. It must therefore be assumed that other foodstuffs besides protein can induce a certain specific dynamic action.

There is another alternative explanation. It may be that the man value is not a true index of the actual consumption by the man in the working-class household. The manual worker may get more than his share of the food provided. The man value may, however, be relatively true of those in sedentary occupations; they may be obtaining just what they require as they have the power to purchase the optimum calorie intake. This assumes that a human being given access to unlimited supplies of food instinctively limits himself to his requisite intake. Coghill has shown that in the dog there is an instinctive limitation of intake. Cathcart says, "May we not assume that the instincts of man are as sound as those of the average dog, and that human 'fat boys' are relatively as rare as the canine pampered Fidos?" If Groups I and II are correctly assessed, then Group III must be under-nourished if 3,095 *calories truly represents the intake.* But the studies did not show that this class of the population as a whole is unhealthy or under-nourished.

There is still another possible explanation. The sedentary, professional or non-labouring population is considered to be of better physique than the manual labouring population, and having a larger surface area the standard metabolism will be higher in the sedentary than in the labouring population. This combined with the steady and often rather strenuous exercise usually taken by the non-labouring class may account for the higher calorie intake.

It seems to us that the most probable explanation is that the man in Group III obtained more food than he was entitled to from the "man value" of the diet. Cathcart made a careful study of five families; the man calorie values varied from 2,934 to 3,162, but the calories of the food actually consumed by the man of the family varied from 3,216 to 3,564, and on the average he received 12 per cent more calories than was indicated by the "man value" result. He also received the extra calories from protein and fat, and it might be inferred, probably correctly, that the man ate most of the meat provided for the family.

The nature of the diet according to the "social class" was then investigated. The households were arranged in six groups: professional class; intermediate class, sub-editors, cashiers, &c.; shopkeepers; skilled

workers; unskilled workers; unemployed. There was a steady decline in the protein consumed from the first to the last group, yet protein as a source of calories remained almost constant throughout.

When supplies were low the distribution of the food was unequal and it was usually the mother and children who suffered. If the householder was a widow, or the father was absent, then the family fared much better; the distribution of calories was more even, there being no necessity to give a hungry man sufficient food to enable him to do his work.

In the unemployed group the calorie return per penny was good, but the calorie intake was very low. The figures were: protein, 57·9 g.; fat, 73·6 g.; carbohydrate, 286·9 g.; calories 2,089; calories per penny, 201.

Where the diets of groups of men, such as postmen, golf-club makers, and ploughmen were studied, it was found that though the mean calorie intake was much the same there were wide variations in the individual diets. For instance, in the group of golf-club makers the protein varied from 72·9 g. to 109 g., and the fat from 95 g. to 140 g.; the results indicate that in a more or less uniform class of workers individual idiosyncrasies must always be taken into consideration when endeavours are made to predetermine a specific diet for them.

The doubt might occur to any one reading these dietary investigations, even although each study was carried out for a week by a competent observer, whether the week selected can be taken as a truly representative week of the dietary of the particular family investigated. Variations might also be introduced as the result of mere seasonal changes, as the original investigation was carried out during the course of spring and early summer.

Cathcart and his co-workers thought that such a doubt was quite a proper one, and demanded an investigation which might be carried out at a different season of the year. They accordingly repeated their observations of thirty-three of the families in the late autumn and winter. The mean results obtained were almost identical with those found in the first study. The expenditure on food in winter per man was slightly up, but the rise was so small that for all practical purposes it may be disregarded.

Clinical and other Notes.

AN UNUSUAL CASE OF CARCINOMA OF THE STOMACH.

By Major R. L. RITCHIE, O.B.E.,
Royal Army Medical Corps.

The following case presents some features of unusual interest and may illustrate the difficulties in diagnosis when the length of the history and the age of the patient would appear to veto the question of malignant disease.

Private C., aged 26, six years' service, has been a known hysterical patient since arrival in Shanghai ten months before admission. Has frequently reported sick at regimental sick parades and has complained of various symptoms, but none referable to the digestive system.

His medical history sheet (A.F.B. 178) shows enteritis, twenty-three days in 1927. Chronic pharyngitis, forty-four days in 1929. Tonsillitis, eleven days in 1929. Hysteria (aphonia, etc.) in 1930. Phimosis (circumcision) three months before present admission.

Admitted on November 11, 1930, from Detention Barracks (where he had been for thirty-five days), with the history that he had refused all food for eight days.

When seen on admission he was cold, pale and collapsed. Refused to answer questions and was apparently oblivious of his surroundings. Was examined and nothing abnormal found in any system, except that deep palpation in the epigastrium appeared to cause him some discomfort. Was put to bed with hot-water bottles, etc., and recovered sufficiently towards evening to give a coherent history. He stated that he had not refused food out of pique or because he did not want it, but because he had, for the last eight days, invariably vomited after a meal. He further stated that he had never suffered from indigestion until eight days previously. He complained of backache and epigastric pain. Temperature 97° F., pulse 108.

In the absence of localizing symptoms the patient was placed on a diet of diluted milk with ice to suck, as he was very thirsty.

During the night the patient vomited once. The vomit consisted of diluted milk with a few streaks of blood. The urine was tested and found to be normal.

On November 12, 1930, the patient seemed to be a little better. He was warm and could talk intelligently. Milk (diluted) was ordered to be given every two hours. The bowels had not moved since admission. During the day the patient vomited twice; on both occasions the vomit consisted of dark "coffee ground" material. The application of an ice-bag to the epigastrium was ordered. Abdominal pain was still complained of.

He still looked very ill, but not so bad as on the previous day. He slept fairly well during the night. Temperature 98° F., pulse 100.

On November 13, as patient's bowels had not moved since admission, an enema was given, and a large "tarry" evacuation followed. At 2 p.m. he vomited a large quantity of fresh blood. He was placed on the "dangerously-ill list" with the provisional diagnosis of acute gastric ulcer, and was given morph. tart., $\frac{1}{4}$ gr., hypodermically. Ice to suck, and ice-bag to be continued. Rectal salines with glucose (10 ounces) to be given every four hours. Morph. tart., $\frac{1}{4}$ gr., repeated at 9 p.m. Frequent mouth-washes to be given, as the patient was very thirsty. He was seen by the Surgical Specialist, who stated that there was then no indication for operative interference.

November 14, 1930. Patient retained and absorbed rectal salines well. He slept for hours at a time during the night, and stated that he felt better in the morning. He had no vomiting all day until at 5.30 p.m., when he vomited about a pint of fresh blood; 2 cubic centimetres hæmostatin were given. At night he appeared to be very ill indeed.

November 15, 1930. Temperature 99·2° F., pulse 108. Condition unchanged since the previous night. Rectal feeds were still being well retained. The pulse was quite good in volume. There was slight vomiting of dark semi-digested blood at 4.30 p.m. The patient complained of no pain whatever. Hæmostatin, 2·5 cubic centimetres, was given at 8 p.m. Blood-count showed: Red blood-cells, 3,430,000; white blood-cells, 9,800; hæmoglobin, fifty-four per cent; colour index, 0·79. He was restless and not inclined to sleep during the early part of the evening. Forty grains of chloral hydrate were given by rectum at 10.30 p.m. The pulse was not so good in the evening and was inclined to be "thready." The backache had returned, but all abdominal pain had gone.

November 16, 1930. Patient appeared much weaker in the morning. The pulse was running and at times imperceptible. He seemed to be sinking fast. A transfusion of 750 cubic centimetres of citrated blood was given at 11.30 a.m. Morph. tart., $\frac{1}{4}$ grain, was given after transfusion. He vomited a large quantity of fresh blood during the afternoon. Rectal salines were not retained. He became unconscious at 6 p.m., and died without regaining consciousness at 7.25 p.m. The pulse had been frequently imperceptible and always uncountable after 2 p.m.

Report on post-mortem examination, November 17, 1930:—

External Examination.—The body was emaciated. Rigor mortis well established and post-mortem staining present.

Abdomen.—The stomach appeared to be contracted, and there was almost complete disappearance of fat from the great omentum. On palpation the pyloric end of the stomach felt hard and nodular and was firmly adherent to surrounding structures. Numerous enlarged mesenteric glands were present, especially in the duodenal flexure, where there was a large hard mass of glands firmly fixed to the posterior gastric wall and to

the pancreas. The cardiac end of the stomach appeared normal and was lying free.

On section the stomach was found to be full of partially digested blood. The walls of the pyloric end were much thickened and hard, and the mucous lining of this part was thrown into large folds containing distended veins. Evidence of erosion of the mucous surface was present in places, but no gross ulceration was seen.

There was a sharp line of demarcation of the infiltration at the pyloric opening, beyond which the intestines were normal but filled with altered blood.

The feel and appearance of the stomach were in every way indicative of an extensive carcinomatous growth involving the whole of the pyloric end of the stomach. The liver on section showed no secondary deposits.

The stomach and a gland were sent to the Municipal Laboratory, Shanghai, on November 17, 1930, and on November 21, 1930, the following report was received:—

"There is an extensive invasion of all the coats of the stomach by large polyhedral cells with hyperchromatic nuclei, many of which contain mucous globules and show the characteristic signet-ring appearance. The gastric lymph nodes are also extensively involved. Histological diagnosis: Diffuse scirrhous carcinoma."

Conclusions.

The case appears to be of interest for three reasons:—

(1) The age of the patient (26 years).

(2) The complete absence of symptoms until two weeks before death. It seems almost incredible that a known hypochondriac, who was constantly attending sick parades, should have made no complaint of a condition which had obviously been going on for many months.

(3) The direction of the lymphatic spread. The liver neither superficially nor on section presented any appearance of metastases. The invasion by secondary deposits appeared to have been entirely in a downward direction and limited to glands in the immediate vicinity of the stomach and duodenum, in spite of the fact that the disease must have been present for a considerable time.

I am indebted to Lieutenant-Colonel T. T. H. Robinson, D.S.O., R.A.M.C., Commanding No. 7 General Hospital, Shanghai, for permission to publish the notes on this unusual case.

———

BALANTIDIUM COLI.

By Colonel F. SMITH, C.B., C.M.G., D.S.O.

The Note in the April, 1931, number of the Journal of the Royal Army Medical Corps, by Major C. J. H. Little, reminds me that years and years ago, at Netley, in the vain search for ova of ankylostomes, I found by chance swarms of balantidia in the excreta of an English cavalry soldier from India, and I spent an enraptured hour in observing the quaint gambols of the very active parasites—ridiculous creatures.

In deference to the wish of the authority then presiding the case was not reported, the Professor being of opinion that the parasite was accidental, non-pathogenic, and quite unconnected with the host's illness.

Invalided home after two years of, off and on, stomachic and intestinal trouble, the hussar was suffering from chronic looseness, occasional finicky pains in the abdomen, a not-over-clean tongue, and slight anæmic debility. Though sallow and spare, he was cheerful, and lively of movement, the disorder being mainly an inconvenience. Moreover, he had put in the necessary minimum of years service to entitle him to a permanent pension if invalided. And sprue and other possible causes being excluded, he was discharged under the generic head represented by his condition—diarrhœa. He took his balantidia with him.

Looking back, one would say the balantidium was the sole cause of the man's state.

I do not know if a specific treatment for the destruction of balantidia has been discovered. I should try thymol if I had a case to treat.

Though the disease might, as Major Little suggests, be overlooked owing to delay in making the necessary examination, it seems likely that the parasites are rare among the troops, especially British troops. For many years, examinations of excreta have been routine in intestinal disorders, yet little has been heard of the balantidium. In my time the above-described case was the only one I knew of.

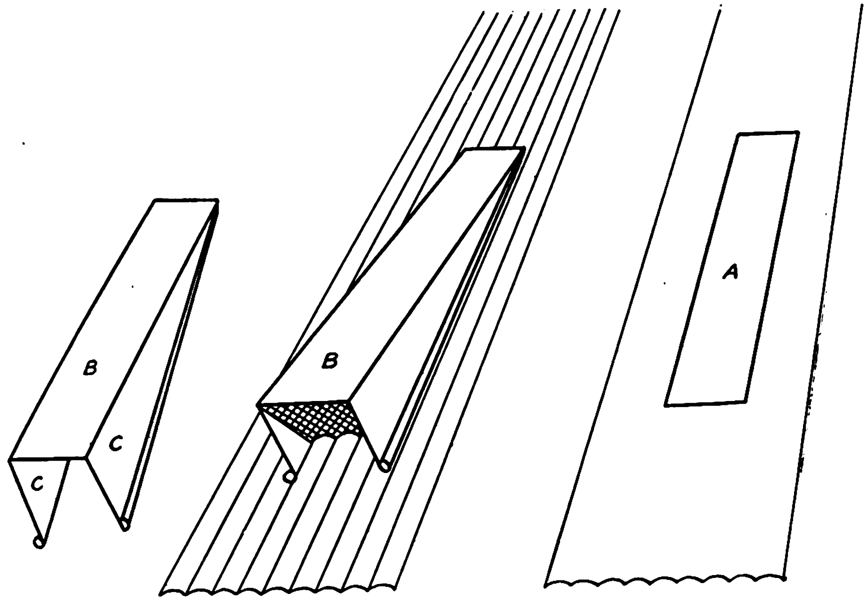
THE PROBLEM OF ROOF VENTILATION IN TROPICAL HOSPITALS.

By F. G. CAWSTON, M.D.

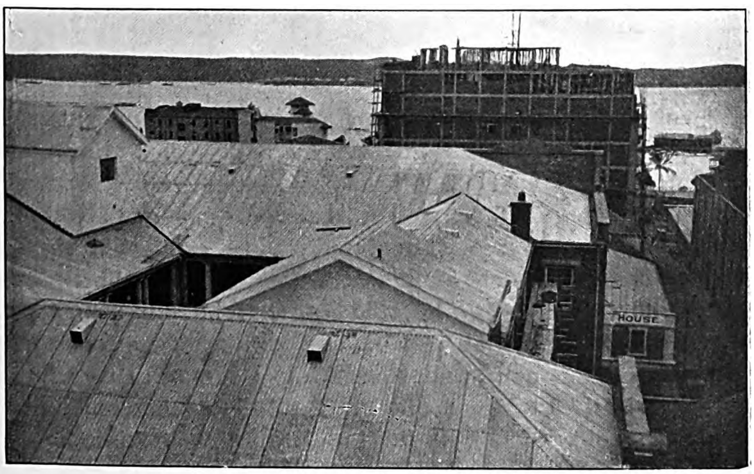
A considerable advance in the treatment of some forms of tropical disease has been rendered possible by the more adequate methods of keeping hospital wards cool even on the hottest days, and in no sphere has this been more clearly defined than in the treatment of heat stroke and sun traumatism. The distinct advantage of darkening rooms for certain nervous and eye complaints has also attracted attention to the need for protecting patients from undue and prolonged exposure to the sun's rays.

An effort has recently been made on the Natal coast to enable dwellings

provided with corrugated iron roofs to be kept as cool as those provided with tiles, even through the hot summer months. The device was inspired by the local humidity of buildings at sea level and by the fact that occasional hail storms rendered tiled roofs less popular than they would otherwise be.



A. = Window
B. = Cover (of metal)



" Roof Coolers " adopted at Durban, Natal, to ensure coolness of a large centrally placed building.

Adequate ventilation of iron roofs demands provision for escape of over-heated air enclosed in the roof, and for a constant inlet of fresh air.

Many of the devices, such as cowls, appear to be unnecessarily expensive, and it was decided to test the effect of cutting out windows in the usual sheet lengths and soldering a metal lid over them, so that there might be ample provision for free ventilation through a square inlet protected by gauze from the intrusion of birds or small animals.

These roof coolers, as they are called, made a strong appeal to some local architects, who tested them on some large buildings and were fully satisfied with the results obtained.

The device was submitted to the Under Secretary of State at the Colonial Office, where it received the approval of the advisory committee, and was passed for exhibition at the London School of Hygiene.

How far the invention may be regarded as original it is difficult to say. But for simplicity and efficacy it would be hard to find a more easily applied system. In order to save trouble to builders the metal cover is soldered on to the sheet lengths in which the necessary outlet has been made by the manufacturers, of whom there are several in Natal and the Transvaal.

It is possible that this system might be more extensively applied in the tropics in order to overcome the excessive heat of general hospitals. It might be used in co-operation with other measures which are already in use.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS.

Royal Army Medical Corps (Ret.).

(*Continued from p. 462, Vol. XVI.*)

We reached Deolali at 3 p.m. and I proceeded to find out where my quarters were situated and as much as I could of my new station. A gentleman in mufti and well set up very politely gave me assistance and soon had all my luggage taken to the married quarters. Nothing could have exceeded his interest in me, nor could I make out who my self-constituted host was, or a reason for his attention. When the last package had gone we walked away, when he told me that he had been very ill but was better. He also added that he would be coming to me for examination at the Annual Medical Board, and then I asked him directly who he was, and he replied, "Serjeant-Major of the Depôt." I thanked him for his help and said that he could rely on me for a thorough examination. I was not pleased with his methods, and later a sequel to this occurred.

Our quarters were small but otherwise comfortable, at the end of a block. Major Tidy occupied the quarters at the opposite end. I reported to

the S.M.O. who was Lieutenant-Colonel John Dallas Edge (now Major-General, retired),a very well-known and distinguished medical officer. I knew him well, as we had served together under Surgeon-General Farrell in the Burmese War. My wife also knew him. Edge had taken on matrimony since we first met him, and we found Mrs. Edge very charming. They had a dear little daughter who was christened "Charlotte Jane," but the natives

Lieut.-Colonel W. A. Morris.

called her "Tomato Bean." How this came about I do not know, but possibly it was started by the child's ayah. We received great kindness from the Edges, who were popular with everyone. Colonel Hallows of the 4th King's commanded at Deolali, and there the permanent staff ended. There was a garrison Paymaster, named Mitchell, who had been a Captain in a Rifle Regiment and had transferred to the Pay Department. He had been stationed at Deolali a great many years, and now was retired at Nassick Road. There was also the Serjeant-Major already alluded to, and a Quartermaster-Serjeant, who was rather a character.

Deolali was pleasantly situated on the downland to the left of the railway, beyond the Ghats, and about fifteen miles from Igatpuri, and five miles from Nassick on the Godavery, one of the oldest cities of the Deccan. There was a large amount of barrack accommodation, which in the trooping season was enlarged by tents, a good mess, and a comfortable though old hospital, a mile away on a hill. I had known this old building before in its palmy days under Surgeon-Major S. S. Skipton, and when Captain S. Moores was the Adjutant. Moores has been a Colonel for a long time, and I hope he is alive now. I last saw him at Portsmouth when starting for one of many trips to the East, and he told me of his brilliant son, now a Major-General. No kinder man than Moores ever lived, and none stricter in carrying out his duties.

My first experience of Deolali was in 1883, when cholera was a frequent visitor and carried off Surgeon Cox, who arrived there with me and died of the disease two days after I left.

In 1893 great sanitary advances had been made. There was a safe water supply, and sanitary arrangements were more efficiently carried out, and food supplies carefully inspected. The climatic conditions were equable and pleasant, and the nights fairly clear and cool.

My vanity as an ex-adjutant of the Volunteer Medical Staff Corps was flattered by a general salute I received every morning from the Serjeant-Major of the Depôt. As I passed he was usually arranging the camp guards, and I must have loomed large as about twenty men braced themselves to attention, while the Serjeant-Major on his toes, with an artistic swing, gracefully saluted me. I returned the salute and murmured to myself, "What's his little game?" This very soon began to develop. This warrant officer had a difficulty in the Serjeants' Mess and fell off his chair, bruising himself. I visited him and, having dealt with the immediate condition, proceeded to take a full case of him generally, and when he was unaware of what I was doing. I never took such a history of any man. I filled seven sheets of foolscap, and then put it in my desk. I felt such an interest in this person that I also obtained a full record of his previous service. At one time he had been a hospital serjeant in Africa, and had served under Dallas Edge. The Serjeant-Major recovered, and I continued to enjoy a sort of changing guard *à la* Whitehall every day, to which was added the flattering opinion that I was "the only doctor who knew anything, and very different from the last."

Tennis, golf, and shooting were my principal recreations, and I often drove to Piplegaum on the Manmad Road, where I got some excellent duck and snipe shooting. This place was twenty-nine miles away, but was well worth the journey.

Golf was a great recreation, and we all played. The course had been cleverly laid out and started with a 120-yard drive over a nullah which required considerable accuracy and skill to negotiate.

Nassick, seven miles away, was a favourite place to go for a change.

We often stayed at the Dak Bungalow, which was very convenient, and made expeditions into the country. The golf course was very popular and I recollect two greens which tried our powers. The first hole was a short one of about 200 yards, in which the least slicing of a drive would land the ball in a fibre plantation. The wary played a careful cleek shot, and a controlled iron to the hole. I dreaded this hole. Another hole at the sixteenth was a drive over a musjid. A bold sweep over repaid the effort, but failure spelt loss of the hole. A slightly set-back spoon was the club for this. A high tee was sometimes risky and not the best style. It was a fascinating hole, and we liked trying our skill at it.

After returning from one of these visits to Nassick, I was confronted with the invaliding papers of the men proposed for the Annual Board. Prominently on this list appeared the Serejant-Major.

I dismissed him with a very cursory examination, as I had quite recently taken and recorded very full notes on his condition. The difficulty that faced me was to "certify on my honour that it was absolutely necessary to send him to England to recover." As I found nothing the matter with him, I declined to certify. This became rapidly known, for the next day I received no Horse Guards welcome and salute, and with it flew every atom of respect I had for this impostor. Unfortunately my S.M.O. could not see it in the same light, nor could I change my opinion. He was annoyed and dismissed me. Nothing further occurred till the P.M.O. (an I.M.S. man) arrived to preside at the Annual Board. Noticing that I had not signed the certificate, he sent for me and asked for my reasons. I bluntly stated that there was nothing at all the matter with the proposed invalid, so he called him in and asked a few leading questions, and satisfied himself that he was suffering from congestion of the liver, and his opinion was supported by the S.M.O. and another Captain. But no one signed the certificate, which went forward unsigned. I felt that I had been beaten, and the next day I told my S.M.O. how sorry I was that this *contretemps* had occurred and asked for a few days leave, determined to forget it.

I started off to Piplegaum, and shortly after I received an urgent letter from the Commander-in-Chief, Bombay Army, directing me to furnish a full explanation with my reasons for not signing the certificate on the Invaliding Documents, and it transpired that the invalid had reported that I had not taken the trouble to examine him. This was too much, and with my notes, and in the freshness of the jungle, I furnished a full explanation. He was ordered to Poona for observation, and then to be examined by five independent medical officers. After three weeks he was discharged as suffering from "no appreciable disease." This elated me at the time, but I believe I suffered for it for the rest of my service. An official communication followed in which I was commended by the C.-in-C. I had a poor time after this, but by using a little interest I was transferred to the Punjab. This was in March, 1894, at the approach of the hot weather. Packing up was a lengthy business, and I had some difficulty with my 'cello, which the

hospital carpenter solved and promised to have it packed in a case and at the train, labelled and ready. We called and wished our friends good-bye, including the Rev. Wingate, brother of the Sirdar of Egypt, who kindly entertained us to dinner on our last evening.

We reached the station the next afternoon, when my attention was immediately drawn to a coffin on the platform screwed down in the most approved manner. I approached it, and to my horror saw my name boldly lettered with my destination Peshawar, one of the hottest places on earth. The mystery was unravelled when I found that the hospital carpenter had utilized coffin boards to pack up my instrument. It was disconcerting to our friends and ourselves to see this coffin, and I was very grateful that he had not put a brass name plate and handles on for luck. Wishing our friends goodbye, we started for a new life in the unrivalled Punjab.

The journey was uneventful, and a day later my wife and children left me at Rawal Pindi and drove to the hill station of Murree, while I proceeded to my destination. I stayed the night at the Peshawar Dak Bungalow, and felt out of sorts and tired, and in a slight fever. It was a trying experience in that dirty place, and in the morning I felt far from well, and my dog was dying. I think he must have drunk the water in the bath room gurrah. I went at once and reported my arrival to the acting P.M.O., a well known character. He had a reputation for thrift unknown in quality, but was a capable officer with a strong personality. I found him in the veranda of his house which he had turned into an office. It was a four-roomed house, of which he occupied two rooms and let another to a medical officer named Brogden. We made up the account at the Mess of this transaction, and found that our P.M.O. paid 40s. rent, and received the exact amount back for the office rent and accommodation for his guest. Fires were unknown here in the winter, and punkahs were not used by him in the summer. However, by seniority, I took charge of the hospital, and my officers were Swan, a good fellow who subsequently became a Surgeon-General; Hathaway, who also reached that rank; Cody O'Donnell, and Brogden, both since dead. Last but not least was Peake, one of the pleasantest and most efficient medical officers I ever met. He was also Mess President, and continually in difficulties with the P.M.O. over the menu. It was rather difficult for Peake because the Chief would not eat breakfast or tea, and by night he was ravenous.

Our Chief had a professed and accurate knowledge of the Regulations, and in council or committee was unrivalled and relentless and would not subscribe to the slightest variation of the meaning of a regulation, and usually came off "top dog."

When I visited the hospital I found all the officers in white when they should have been in khaki, and I immediately ordered khaki to be worn in the future, with which all cheerfully complied. The next day opened with as smart looking officers as could be wished, and all were pleased, for they had brought the matter to my notice themselves. The following morning the P.M.O. walked into the office dressed in white, and in an awful voice

of a nasal-oral character said, "Who told you to order khaki?" I at once replied and produced the Regulations, "This is the authority, sir." He waved it on one side, and said, "Take it off and wear white." We complied very unwillingly, and that is the only regulation I ever knew him ignore, and later I heard it nearly broke him in the Irish Command. Although B. was so unusual, there was one trait about him which I am delighted to report—he did not possess one atom of malice or desire to hurt anyone, and I do not think he ever did. When he died he left £129,000.

This was a very unhealthy year at Peshawar. A simple remittent fever filled the hospital and several tent-wards in addition, which gave me ample material for reflection. Later we were overtaken by a severe epidemic of enteric fever, and this was followed in the autumn by severe remittent fever and many fatal cases. The water supply was small and inadequate, but has since been replaced by an excellent service. Through the centre of Peshawar cantonment ran a canal which was used for all purposes. At the beginning of the enteric invasion I kept a personal watch on milk and the can washing, and more than once in one regiment I could never find any cans, and no one seemed to know where they were. One morning I was sitting on my horse, and out of sight except that I could see the bazaar by the canal, and as I watched I actually saw the milk cans lifted out of the canal and taken to the contractor's dairy. The next afternoon I took the orderly officer and the quartermaster to the canal, and handed them all their cans out of this foul stream. The contractor had to admit that he placed them them there to wash in the stream, and took them out to cool in the afternoon. This led me to regard all the earlier cases of the spring as mild enteric.

It was about this time that the late Surgeon-General J. B. Hamilton was P.M.O. of the Lucknow district, and he evidently did not like the expression "simple continued fever," and I believe gave an order that all cases of this nature lasting more than seven days were to be returned as enteric fever.

In the autumn I became very ill myself with dysentery, but fortunately it was not severe and I soon recovered. I had had a very trying time, but P.M.O. Brown helped and encouraged me in every possible way and about this time called me up and told me that I had been selected for the Staff-Surgeoncy at Rawal Pindi and, what was still more gratifying, that my gazette as a Surgeon-Major had come through. My brother officers advised me to go to the bank and see what arrears of Major's pay were due to me. I put on spurs immediately and paid Bickley Roe of the Punjab Bank a visit. As I approached him, I hooked up one of his chairs and over it went, but after a pleasant interview I returned to the Mess, with grass and twigs in my spurs, which I had picked up as I walked from the bank. Reaching the Mess I found it full of ponies and Pathans who surrounded me and tried to sell me a horse. This was a harmless practical joke which was amusing.

At Peshawar I met Colonel Warburton, the distinguished Warden of the Khyber Pass and one of the most interesting men of that day. A thin man with a clever kind face, and a pleasant manner, and very popular. This was the twenty-ninth hot weather he had spent in Peshawar. I served with him later on the Headquarters Staff of the Tirah Field Force; he rendered the most efficient and valuable service in that campaign, and became Sir Robert and a Knight Commander of the Star of India. A few years later he died in England and no one regrets the gentle Warburton more than I do. Colonel Sir Aslam Khan was his second in command. He was an Afghan of high birth, a great friend of the British, and a most loyal subject of the Queen. I knew him well.

Last but not least the Rev. Father Waterhouse was a striking and popular character. He was familiarly called Father John. He was a regular visitor at the Club, but never after sunset, for then he would go to his recreation rooms and devote the evening to his soldiers who loved him. He was invited to adjust the Club Library, and on many mornings Father John could be seen examining volume after volume, and every now and then consigning one of which he did not approve to the flames of a fire outside. Later he had to leave India on account of ill-health, and lost one of his legs by amputation. When I last heard of him he was living at Schevening, near The Hague.

The Anglican padre was the Rev. Nicholl, also a popular officer. He caught me one day giving my hospital writer a dressing down, and the following day left me a little parcel of what he called "good-tempered nibs."

Major-General Sir A. A. Kinloch, C.B., commanded at Peshawar. He was a great sportsman, and wrote a first-class book on Himalayan shooting. A pleasant man so far as I knew him, but he had a "bee in his bonnet," for he would never wear a solah topee even in the hottest sun. It was positively tragic to see him wearing a cloth cap in the broiling heat, a habit, I understand, he lived long enough to regret.

"Cody" O'Donnell was one of my officers and one of the best gentlemen riders in India. He was the younger of two brothers, the other being "O'D.," as he was called. I served with O'D. afterwards, but though I never knew him intimately I admired and liked him. He also was a fearless horseman. O'D. became a Surgeon-General, but dear old "Cody" succumbed to liver abscess on the Bombay side a few years later. "Cody" was credited with having brained a stallion which ran amok from the bazaar at Peshawar, and reaching the polo ground chased him. "Cody" got a good swing on his club and laid the horse out, and just in time, for his mare was getting exhausted.

Having completed the transfer of my charge, I left Peshawar for Rawal Pindi in October, 1894, and settled down with my wife and children in a small house in Church Lines near the hospital, and took over the duties of Staff Surgeon.

General Sir William Ellis commanded at this time, and his son was his A.D.C. Arthur Ellis I had known in the Yorkshire Light Infantry at

Dinapur and at Chunar. I last saw him in Burma, and have never met him since, though I have spoken to him over the telephone on affairs of National Service at Cardiff from my office at Swansea. A year or so later Sir William died of cholera on his way to Naini Tal. He contracted it during an inspection and could not shake it off. Sir William was a clever, well-informed man, a splendid soldier, and popular. Colonel Thomas Maunsell was the P.M.O., and later became Sir Thomas for his services as P.M.O. of the Chitral Expedition. He was a tall, handsome man, Irish, and with all the charming refinement of that race. We were frequent visitors at his house, where Mrs. Maunsell dispensed hospitality to everyone. He had a large family and also the misfortune to lose two sons in the Great War. Brigade-Surgeon Pollock was in charge of the hospital, and was another refined and charming officer. I had met him once before in my early service and was pleased to come under him. Pollock was a tall, handsome man of very much the same type as Colonel Maunsell. Colonel Pollock was the uncle of the late Major-General C. E. Pollock, at one time D.D.G. at the War Office. C. E. Pollock was a serjeant in the V.M.S.C. when I was adjutant, and I remember well the serious and thorough way he carried out his duties.

The Mess of the Medical Staff at Rawal Pindi was a charming place even in its early days. Our garden parties were a feature of the winter season, and many pleasant evenings have I spent in the old house.

My work as Staff Surgeon took up all my time, for it included a number of private cases, police work, and consultation.

The work of Staff Surgeon was heavy, and I was glad when March arrived and the exodus from the plains commenced and visitors returned to Europe. I had taken Annat Abbey at Murree for my family and looked forward to spending some of the hot weather in that delightful and cool place.

We were quite a friendly society in Murree that year, the first under the new organization of four commands, prior to Lord Kitchener's organization of a Northern and Southern Army.

Sir William Lockhart commanded the Punjab Army, and I was much in touch with him, but at Murree the local surgeon looked after him. Later "Juggins" Morgan was his Staff Surgeon. Lady Lockhart was with him and they entertained royally at The Terrace. These evenings were delightful for us and the Lockharts very popular.

By October all the troops had marched from the hills and were getting ready for winter manœuvres. Colonel Maunsell had been promoted and was succeeded by Colonel Carew, and Colonel Pollock was succeeded by Colonel Ring at the station hospital. We had a charming lot of men at our Mess. O'Brien (Lieutenant-Colonel), Manus O'Keefe, self, Whitehead, Stanistreet, Gerard, Burtchaell, Bewlay and H. M. Buist (Beauty and the Beast), L. P. More, and Beyts. We formed a happy party and had some very pleasant guest nights.

A very sad calamity overtook General Crealock, who succeeded Sir

William Ellis. The G.O.C's. residence not being ready the General put up temporarily at the Club, and one morning I was called to him and found him collapsed, and suspected cholera. However, active treatment improved his condition; he was desperately ill, and we took him to our house where he improved for a short time, but later succumbed to heart failure. In searching for the cause of this General's death, I found that the tin of herrings from which he had received his breakfast the day before he had been taken ill had been opened, and the fish not taken from the tin, in fact there was still some of the stale fish remaining. The cause of death was acute gastritis. General Crealock was one of two soldier brothers who distinguished themselves in the wars in South Africa in the eighties. He was buried with full military honours, which in a garrison of 12,000 men was a great and very sad pageant. When we buried the General arrangements were made to send the body subsequently to England, and towards the autumn of that year it fell to me to supervise the exhumation; this was done, and the body placed privately in a railway van and despatched to England.

General Crealock was succeeded by Major-General Moorson, who had served in the Crimea and in many other campaigns with great distinction. He was a charming and polished old-fashioned soldier, but fully abreast of the work required of him at Pindi. He loved horses and was constantly in the saddle.

The Command system was fully working this winter, and Sir William Lockhart commanded and lived in a large camp on the Mall. Surgeon-General Robert Harvey, I.M.S., was the P.M.O. It is nearly twenty years since the genial and electric Sir Robert Harvey passed over the border. Surgeon-General Harvey had spent most of his early service in Calcutta, chiefly as Professor of Obstetrics, and in charge of a large hospital. He did remarkable work, and in his later service passed to the military side and rose to the highest post in the Punjab Army.

The Chitral Campaign had been fought and won and warriors were returning every day. Our Mess had been considerably depleted, but I recollect the return of Hanley, who was M.O. to the K.O.S.B. and had performed very distinguished service with them in that war. Hanley was very popular in the Mess, and was a blunt direct sort of man who had worn a national cap for football and could sing a good Irish song. Hanley married and lived for a time at Murree, dying later in Dublin.

We made a new friend this winter in Colonel Yaldwyn, Chief Supply and Transport Officer in Pindi. He had lately returned from Chitral and was an artist of no mean order. He often came with us sketching.

On one of these expeditions my wife, who was never over-strong, contracted pneumonia and after, a hard fight for life, died, and I was left with my two little children.

Sir William and Lady Lockhart frequently visited my children, who remained with me until I could send them home.

(*To be continued*.)

Current Literature.

SAYERS, R. R., and MERIWETHER, F. V. **Miliary Lung Disease due to an Unknown Cause.** *U.S. Public Health Reports.* 1930, 45, 2994.

In 1927, the Bureau of Mines, the Metropolitan Life Assurance Company and the Lead Ore Producers' Association established at Picher, Oklahoma, a clinic for the study of silicosis and tuberculosis in miners. During the investigation over 18,000 men were examined and occasionally there was found, on X-ray examination, a condition of shot-like spots scattered over the lung areas. The appearance resembled somewhat that seen in miliary tuberculosis, "but, in many cases, the history was practically negative, without symptoms, and with two exceptions, all subjects were apparently healthy."

One case was in an Indian but the others were in white Americans and their ages varied from 16 to 69 years. 125 cases were studied; about forty per cent had worked in mines for less than four years. Fifty-four per cent had been farmers, but, all the others, except one, came from agricultural areas where wheat and hay were produced.

Fully sixty-five per cent had no symptoms and in the others the subjective symptoms were chiefly dyspnœa, cough, and the expectoration of blood-stained mucus. The symptoms appeared to remain stationary or to improve slightly.

Twenty-nine of the cases were radiologically examined over two years and in only two the condition advanced, and these two were found to be tubercular.

"The bacteriological examinations of the sputum of the first ten or twelve were considered to be negative." Then a fungus was found in an unstained smear of the sputum of a case and all the others examined, thirty in number, showed a fungus. Two types of fungus have been identified, *Aspergillus fumigatus fisheri* and *A. niger*.

Antigens were prepared from the two fungi and dermal tests were made. *A. niger* antigen gave a positive result in each of six cases tested and *A. fumigatus fisheri* antigen, used at the same time in these patients, gave a weak reaction in one of them. The latter antigen when used on ten other cases gave a negative result.

The mouths of men working about the mines were examined and in one "a similar fungus was found."

Examinations of mine dust gave negative results.

Two culture-media plates were exposed in wheat stacks and two in wheat wagons, and each plate showed a growth of fungus said to resemble closely the fungi found in the sputa of the men. The authors discuss whether the condition may be healed miliary tuberculosis, pneumoconiosis, calcium metastasis, or pneumomycosis and they state that they are unable to come to a definite conclusion as to the cause of this lung condition, which merits further study.

D. GOUGEROT, FIESSINGER, BRUNO and DALY. **Two Cases of Syphilization by Transfusion for Rejuvenation.** *Annales des Maladies Vénériennes.* 1931, 26, 174.

These cases were recorded, not for their scientific interest, since Spillmann and Moue, in 1926, described a case of syphilis without chancre, contracted by intravenous inoculation, but because they were important from the point of view of prophylaxis.

The two cases were apparently infected in May, 1930, and by the same doctor. The authors consider that transfusion should only be used in cases of urgency and real danger. The first patient was a female, aged about 50, suffering from anæmia. In 1928 she was told by a doctor that he could cure the anæmia and rejuvenate the whole body, so she submitted to a course of twelve injections of serum obtained a few hours previously from young subjects, the injections being given at two days' intervals.

At the end of the course of injections, the blood-picture was said to have improved and the patient stated that she felt better and more active, so, when a second course was suggested in 1930, she willingly submitted to it.

The second course was completed in May, 1930 and in August she noticed a roseolar eruption which was found to be due to syphilis. Risks of infection were denied and there was no evidence of any other lesion.

The practitioner who had carried out the injections stated that the donor of the last injection had been found to be syphilitic and had developed a rash a few weeks after that injection. The only precautions taken to preclude the danger of syphilis were occasional Wassermann reactions and the addition of five milligrammes of cyanide of mercury to each dose of serum.

The second patient was a woman, aged about 60, with a "fragile liver" and, being fatigued, she was treated by the same practitioner as in the previous case and in the same manner. She received twelve injections of serum from various donors and the course of treatment ended early in May, 1930. Macules and papules were seen about the end of June and the Wassermann reaction was positive.

At a meeting of the Société Française de Dermatologie et Syphilologie, held on December 11, 1930, when these two observations were presented, M. Hudelo stated that he had a case from the same source and that he knew of a fourth one. M. Hudelo's patient was a man, aged 39, who had received twelve injections from one donor and then four more from another donor. About three months after the last injection a typical secondary roseolar eruption appeared and the Wassermann and Hecht reactions were positive.

Recent risks of infection were denied and there was no evidence of a primary sore.

Reviews.

Military Preventive Medicine. By George C. Dunham, M.A., M.D., D.P.H., D.T.M. & H.; Major, Medical Corps, U.S. Army; Director, Department of Sanitation, Medical Field Service School.

This volume of xxii + 1051 pages was issued in 1930 as *The Army Medical Bulletin*, No. 23, of the United States Army.

Its object, as stated in the preface, is to incorporate under one cover the major portion of the basic information essential to the practice of preventive medicine in the army, a laudable object which is achieved with a remarkable degree of success.

In dealing with the various subjects essentials only are given, yet the size of the volume is some indication of the vast field covered by modern military preventive medicine.

Pages v to xvii are taken up with a Foreword, Preface and List of Illustrations. The remainder of the volume is divided into twenty-six chapters occupying 1,000 pages and a full index of fifty-one pages. The majority of chapters are very well illustrated and it is a pity that Chapters V, IX and X are somewhat deficient in this respect.

The rôle of military preventive medicine and the responsibility for health measures are adequately discussed in the introductory chapter and this is followed in sequence in the succeeding chapters by the following subjects: Basic principles of military epidemiology; control of respiratory diseases; housing of troops; control of intestinal diseases; water purification; sanitation of swimming pools; food control; meat inspection; inspection of poultry, eggs and fish; dairy and milk plant sanitation; mess sanitation; waste disposal; sewage treatment; disposal of human wastes in temporary camps and bivouacs; disposal of kitchen wastes; disposal of manure; fly control; rat control; control of insect-borne diseases; mosquito control; control of lice; control of other insects; control of venereal disease; control of miscellaneous diseases; sanitary surveys and sanitary orders.

On the whole the teaching, principles and practice set forth correspond very closely to our own, but there are a number of interesting differences of which the following are a few examples: In the prevention of smallpox all military personnel are said to be revaccinated at three-year intervals, in contradistinction to our seven- and five-year intervals for home and abroad respectively; again, while advocating few beds in barrack rooms as important in limiting the spread of respiratory diseases, a number up to thirty is not regarded as excessive, whereas in our latest barrack designs we aim at half this number; their arrangements for the supply of water in the field through the services of an Engineer Water Supply Battalion are more elaborate than in our Army; in the chapter on disinfection and disinfestation no mention is made of the uses and advantages of downward displacement current steam.

The chief characteristic of the book is its readableness. The teaching is simply and clearly given and is consequently readily grasped, and while the writer is obviously an idealist he is doubtless well aware of the fact and deliberately preaches the ideal in the hope of getting somewhere near his goal in army practice.

Officers who are interested in preventive medicine are advised to read this book. They will perhaps find a good deal with which they disagree, but they will also find interesting comparisons with our own practice and much valuable information.

AN INTRODUCTION TO PRACTICAL BACTERIOLOGY. Third Edition. By T. J. Mackie, M.D., D.P.H., and J. E. McCARTNEY, M.D., D.Sc. Edinburgh: E. and S. Livingstone. 1931. Pp. xv + 421. Price 10s. 6d. net.

This book was originally published in 1925 and is already in its third edition which, in itself, is sufficient evidence of its popularity. In revising the present edition the authors, as is usually the case with books of this nature, have found it necessary to make many additions without being able to delete an equivalent amount of obsolete material. But although the book has increased by 100 pages since the first edition was produced it is still of a convenient size and remains a most excellent introduction to practical bacteriology.

The general arrangement of the book is unaltered except that, in order to save space, small type has been used for certain paragraphs. The use of varying types of print for headings has not been employed to the best advantage and this fault, which occurred in the first edition, appears to be accentuated in the one under review.

Much new material has been added throughout the book amongst which one notices a very good account of the Brucella infections. Recent work on such subjects as yellow fever, psittacosis and receptor analysis is recorded in short paragraphs.

The best sections are those concerned with the practical diagnosis of bacterial infections, a branch which is of such essential value to the medical student. The importance of early accurate diagnosis of intestinal bacterial infections is not always appreciated by the beginner, so that the concise descriptions of the practical methods employed in the diagnosis of typhoid and paratyphoid fevers, dysentery and cholera are especially welcome.

It is unfortunate that the opportunity was not taken of revising the description of some of the protozoa, the accuracy of which, on occasions, may be questioned. For instance, it is doubtful if any protozoologist would agree with the statement: " The nuclei (of the cysts of *E. histolytica*) contain more chromatin than the nucleus of the vegetative form, and show a distinct karyosome with a central chromatin dot."

But these, perhaps, are small matters if one considers the book as a whole. It is one of the best of its kind and the reading is easy enough to

enable the medical student to absorb the essential material and to begin his professional life with a sound conception of laboratory technique.

Official History of the Australian Army Medical Services, 1914-1918. Volume I.—Part I, the Gallipoli Campaign; Part II, the Campaign in Sinai and Palestine; Part III, the Occupation of German New Guinea. Pp. xxvi + 835. 228 illustrations, maps and graphs. Published by the Australian War Memorial, Melbourne. Price 21s. 6d., post free.

The first volume of the Official History of the Australian Army Medical Services in the Great War describes in detail the work of the Australian Army Medical Corps in Gallipoli and in the Sinai and Palestine campaigns. There is much more in the book than just an account of the experiences of the various medical units, for the Editor, Colonel A. G. Butler, deals at some length with policy and with the conditions that controlled all that happened between the front lines and the Base.

Part I—the story of the Gallipoli campaign—takes up more than half the volume, and here the author deals widely with the general problems of a Medical Service in combined naval and military operations, a subject which, until this campaign, was almost entirely unexplored and of which even now comparatively little has been written.

Australia had very special difficulties. The carrying out in a Dominion Army of principles laid down by the medical authorities of the British Army opened up the whole field of the relations of the Dominion Service to that of the Mother Country, and the solving of the problems involved in this relationship possess far more than a mere academic interest. The administrators of the Medical Services of the Australian military forces were, just like their executive medical officers, civil practitioners without any very special training who became suddenly responsible for the medical side of a great military organization. They, of course, made some mistakes, for which they criticize themselves unsparingly, but it is to their great credit that they made so very few.

The health history of the voyage of the 20,708 troops and 7,479 horses from Australia to Egypt, first arrests attention. Anti-typhoid inoculation and vaccination were energetically proceeded with. A memorandum from the G.O.C., A.I.F., explaining the objects of these procedures, made things easy for the medical officers. Refusals were simply not accepted. As the author points out, at no time did straightforward methods based on reason fail with the Australian troops.

Almost as soon as they arrived in Egypt, and at the very commencement of their training, the Medical Divisional units had to cope with a big outbreak of disease. They soon found themselves immobilized, and it was not until January 25, 1915, that they were able to free themselves and get on with their proper work.

Colonel Butler's intimate historical study of the Gallipoli campaign should be read by all medical officers. The causes and consequences of the

confusion in the clearance of the wounded which occurred in connection with the landing are traced and exposed. The fight with disease—a menace more serious than the enemy's fire—is followed in detail. The causes of the general collapse in health, which occurred among all ranks and against which the majority struggled to carry on, are analysed, and methods of prevention critically examined.

The final impartial summing-up of the medical aspects of the campaign is a fine piece of work, and few will dispute the judgment. While the causes of failure, says the author, were in part special and personal, they were also undoubtedly due in a large measure to factors inherent in the nature of war itself.

Part II of the Official History deals with the campaign in Sinai and Palestine. The author is Colonel R. M. Downes. There is a Foreword by Major-General R. H. Luce, late D.M.S., Egyptian Expeditionary Force.

Prior to the Great War, no one had any real knowledge of medical arrangements on modern lines in open cavalry warfare. Here we have a detailed description of such medical work. The reader who has but his experiences in France as a guide is at once struck with the thought "how different it all was out there." One of the first things discovered was the unsuitability of the 30 lb. Army stretcher for horse transport—a thing which should have been known before.

The knowledge of disease prevention learnt at great cost in Gallipoli was now well applied, and gave good results. A control of the fly pest was secured. The health of the troops in the desert was excellent.

Towards the end of the story, we read how a sudden outbreak of malignant tertian malaria in October, 1918, put a whole cavalry division out of action and left hardly sufficient men to feed the horses. At Damascus and along the lines of communication, epidemic disease had suddenly assumed startling proportions. There was nearly a serious medical breakdown, but prompt measures were taken and by the end of the month the situation was normal.

Should ever another emergency arise and Australia become again involved in a great defensive war, this record which gives in detail the problems of that "civilian" Service will be simply invaluable.

A. C. H. G.

Correspondence.

RABBIT-ENCEPHALITIS IN RELATION TO POST-VACCINAL ENCEPHALITIS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I be allowed to make a couple of corrections in my article on p. 278 of the April number of the Journal? In the first place, the derangement of the normal cell-function of blood-digestion is not, of course, the *root*-cause of the hæmatophagic diseases; it is the proximal,

or immediate cause. The root-cause is the particular ferment-virus concerned in each case. Secondly, rabies and the formation of Negri bodies represent primarily and solely an *ectodermosis*. The disease is not *only* a neurotropic one, because other ectodermic structures, especially the salivary glands, are also affected, and small Negri bodies may, indeed, be developed in the latter.

I am, Sir, etc.,
H. M. Woodcock.

NINETY-NINTH ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION, EASTBOURNE, 1931.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—I should like to draw the attention of Officers who are members of the B.M.A. to the meeting of the B.M.A. to be held here in July, and particularly to the Section of Pathology, as some of the subjects may be of interest to them.

July 23.—" Diseases Conveyed by Milk, other than T.B."

(1) Undulant Fever. Opener, Sir W. Dalrymple Champneys, Bart.
(2) Scarlatinal and Septicæmic Diseases. Opener, Colonel E. Wilkinson.
(3) Infantile Diarrhœa. Opener, Dr. A. V. Neale, of Birmingham.

Other speakers will be: Professor Murray Drennan, Dr. R. A. Glegg, of Lewes, the Rt. Hon. Lord Moynihan, Professor J. W. Bigger, and Dr. A. G. Shera.

July 24.—" The Factors which Determine the Difference of an Epidemic of one Disease from that of another."

To be opened by Professor Major Greenwood, followed by Professor W. W. C. Topley.

I am, etc.,
T. A. Weston,
Major, R.A.M.C. (Ret.),
Local Secretary.

Chiswick House,
Eastbourne.
May 21, 1931.

Notice.

CONGRESS OF THE ROYAL SANITARY INSTITUTE.

The forty-second Congress of the Royal Sanitary Institute will be held in Glasgow from July 4 to July 11, 1931, under the presidency of Sir Henry Mechan, D.L., J.P.

The Inaugural Address will be given by Sir Henry Mechan in the Royal Technical College, Glasgow, on Monday, July 6, at 3 p.m. Dr. Charles Porter, Chairman of the Council, will preside.

The Health Exhibition will be opened at the M'Lellan Galleries, Sauchiehall Street, Glasgow, on July 6, at 5 p.m., by the Right Hon. The Lord Provost, Thomas Kelly, Esq.

A Lecture to the Congress on "A Continuous Health Policy" will be given by Major Walter Elliot, M.P., LL.D., D.Sc., M.B., in the Royal Technical College, Glasgow, on Friday, July 10, at 8 p.m. The Chair will be taken by Sir Henry Mechan, President of the Congress.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C. 2.

Vol. LVII. August 1931. No. 2.

Journal

of the

Royal Army Medical Corps.

Original Communications.

CONTROL OF SALIVA-BORNE INFECTIONS: AN EPIDEMIC OF INFLUENZA.

By Major T. O. THOMPSON,
Royal Army Medical Corps.

The perusal of an article in the February number of this Journal by Cumming [1] on "Saliva-borne Disease Control: Eradication," and a very pertinent letter by the Professor of Hygiene [2] in reference to this article in the same number, suggested that a most excellent opportunity of testing Cumming's conclusions, or at least of carrying out investigations on similar lines, was actually available at that very time in the Aldershot Command.

An epidemic of influenza of moderate intensity was actually in progress in the Aldershot Command, and considerable numbers of men in many units in different barracks were being, or had been, admitted to hospital with the disease.

Permission was therefore obtained to carry out an investigation to see whether there appeared to be any relationship between the rate of incidence in the various units in different areas and any possible difference in the washing-up arrangements of feeding utensils in vogue in these units.

Cumming in his article indicates that what he calls the "mess-kit wash water" was the actual link by which saliva-borne organisms were transferred from the infected man to the non-infected susceptible. He also shows that so important is this chain of infection that proper sterilization of mess utensils causes a reduction of the influenza rate to 1 per cent

compared with 5 per cent in the unprotected groups. Low, in his letter mentioned above, points out that "at least half the table utensils of the British Army are washed in lukewarm water," and that an investigation of this route as a possible link of infection in droplet or saliva-borne disease might prove of the utmost value.

The investigation was carried out towards the end of the epidemic at times made available between ordinary routine work, and was therefore limited to the incidence of influenza, as shown by admissions to hospital. Certain units which showed marked divergence from the average were examined to ascertain whether there was any particular difference in methods of washing table utensils which could be held to account for this variation. The investigation covered a population of nearly 23,000 men.

Complete lists of admissions were obtained from the books of the hospitals concerned; these lists were reduced to percentage rates for units, and the units were grouped together according to formations or propinquity of barracks. The period chosen was from the commencement of the influenza epidemic, January 5, 1931, to the end of February, 1931, and the results were worked out for this period. The incidence definitely fell off at the end of February, and it appeared as if the epidemic might be at an end, but a recrudescence occurred in the second week in March and continued till the end of that month. The admissions for March were therefore also extracted and worked into the unit lists, but only confirmed the previous findings in the majority of cases. The March admissions are of particular interest in that they occurred certainly after the strict ordinary preventive measures against the epidemic had come into use throughout the area.

One fact which became evident in obtaining the lists of admissions was the relatively few admissions of non-commissioned officers. This feature was so noticeable after the first few pages had been extracted that a check back to the beginning was carried out and a full record of N.C.O.'s obtained. Two explanations may be put forward to account for this. The N.C.O. is more hardy and enduring and less inclined to go sick and be actually admitted to hospital; or he is less open to infection because he is either married and lives with his family in separate quarters or lives and feeds in a separate mess. Investigation of a number of serjeants' messes showed that in practically every case washing up of table utensils is done collectively with an adequate supply of really hot, fresh tap-water, and therefore cross-infection would probably be reduced to a minimum or eliminated. The exception to this was the A.S.P.T., in whch all are NC.O.'s and which produced an incidence of 18 per cent, i.e., 19 out of the total of 53 N.C.O.'s infected. In this unit all the students are N.C.O.'s and mess in two central messes; table utensils are common mess property and all washing is done collectively by dining-room attendants in the dining huts. The washing is done in tubs, buckets and bowls, with water which is carried

over from the cook-house some forty yards away and, according to Cumming's contention, is just the method to ensure spread of salivary organisms. The difference between the incidence amongst these N.C.O.'s and the N.C.O.'s of the whole area is highly suggestive.

Owing to the flood of admissions to hospital and the consequent possibility that hospital admissions did not represent the full amount of sickness from all units, several medical inspection rooms in barracks in different areas were included in the investigation. The results were not very illuminating. The numbers of sick were of course larger, but diagnosis was more uncertain, and a diagnosis of actual influenza, as against acute pharyngitis or catarrh, depended on the inclination of the medical officer of the time. Two things did become evident, namely, that the proportion of N.C.O.'s to lower ranks was about the same as for hospital admissions, and that the relative proportion of sick as shown by barrack treatment and by hospital admissions for units or subdivisions of units was the same, and therefore admissions to hospital could be used as a true index of the whole epidemic. A summary of the results obtained is given in Table A.

TABLE "A."

Period—January 5 *to February* 28, 1931.

Summary of Incidence of Influenza.

A.—*Officers.* *General Sick Rate* .. 5·3 per cent

Influenza .. .. 2·5 ,,	Officers, excluding medical..	1·3 per cent
	R.A.M.C.	14·0 ,,
	Q.A.I.M.N.S.	24·0 ,,

Total Admissions 73

Hospital and Sick in Quarters.
Influenza 34

Of the 34 cases of influenza, 17 were actively concerned with sick (i.e., R.A.M.C., Q.A.I.M.N.S., and Chaplains).

B.—*N.C.Os.* (*Corporals and upwards*).
(excluding A.S.P.T.) .. 1·1 per cent. (Total N.C.O.'s gave 53 cases of which 19 were A.S.P.T.)

C.—*Other Ranks.*—Influenza cases .. 1,141 cases = 5·5 per cent. Strength, 22,820.

Cavalry.	7th Hussars ..	.. 11·6 per cent	Wellington Lines (B Squadron. 31 cases)
			,, ,, (A ,, 16 cases)
			,, ,, (M ,, 6 cases)
			,, ,, (HQ. ,, 4 cases)
	5th I.D. Guards	.. 8·0 ,,	Wellington Lines
	R.H. Artillery	.. 6·9 ,,	,, ,, (M Bty. 12 cases)
			,, ,, (D ,, 11 cases)
			,, ,, (F ,, 7 cases)
	8th Hussars..	.. 6·1 ,,	,, ,, (B Squadron. 13 cases)
			,, ,, (A ,, 4 cases)
			,, ,, (HQ. ,, 10 cases)
Infantry.	Suffolk Regt.	.. 14·9 ,,	Blackdown (C Coy. 18, MG 17, HQ. 27 cases. A and B Coys. 9 cases each)
	King's Regt...	.. 8·8 ,,	Marlborough Lines
	2/Royal Berks	.. 8·7 ,,	Salamanca Barracks (HQ. 10, C 9, A 5, B 2 cases)
	Royal West Kents	.. 8·3 ,,	Marlborough Lines (MG 12, A, B, C and HQ. 6-9 cases each)

TABLE "A" (*continued*).

Guards Brigade	2/Scots Guards	7·9 per cent	Stanhope Lines	
	2/Cheshire Regt.	6·1 ,,	,, ,,	
	Green Howards	4·8 ,,	,, ,,	
	2/Coldstream Guards	4·7 ,,	,, ,,	
	Somerset Regt.	7·8 ,,	Blackdown (HQ. 18, D 11 cases, A and C [2 cases each)	
	Camerons	7·0 ,,	Marlborough Lines	
	Royal Scots	6·6 ,,	Wellington Lines	
	Devon Regt.	6·1 ,,	Bordon	
	D.C.L.I.	4·6 ,,	Marlborough Lines	
	Beds and Herts	4·5 ,,	Bordon (HQ 10, MG 7, A, B and C 1-3 cases [each)	
	K.S.L.I.	4·5 ,,	Wellington Lines	
	Duke of Wellington's	4·3 ,,	Stanhope Lines	
	Loyal Regt.	4·0 ,,	Marlborough Lines	
	Border Regt.	3·7 ,,	Bordon	
	R.S. Fusiliers	0·9 ,,	Bordon	

R.A.M.C.		
Nos. 1 and 2 Coys.	12·0 per cent	Engaged in nursing duties at the Cambridge and the Connaught Hospitals
Depot	2·4 ,,	Crookham. A training centre with 500 recruits
R.A.O.C.	1·9 ,,	
Mil. Police and Detention Barracks	4·1 ,,	
R.A.		
4th Light Brigade	9·2 ,,	Deepcut (21st Bty. 16, 20th Bty. 9, 15th Bty. 12 cases)
13th Brigade	7·2 ,,	Marlborough Lines
1st Air Defence Brigade	6 6 ,,	Blackdown (1st Bty. 10, 3rd Bty. 8, 2nd Bty. 2 cases)
11th Brigade	4·7 ,,	Waterloo Barracks, East
10th Brigade	3·7 ,,	Deepcut
7th Brigade	3·3 ,,	Bordon (16th Bty. 7, 9th Bty. 1 case)
6th Brigade	2·0 ,,	Bordon (69th Bty. 6, 77th Bty. 1 case)
1st Light Brigade	1·9 ,,	Ewshott
R.E.		
Mounted Depot	11·9 ,,	Stanhope Lines. Recruits under training
5th Fld. Coy.	5·0 ,,	Stanhope Lines
12th Fld. Coy.	3·1 ,,	,, ,,
1st Fld. Squadron	2·5 ,,	,, ,,
23rd Fld. Coy. / 26th Fld. Coy. / 38th Fld. Coy.	1·6 ,,	,, ,,
11th Fld. Coy.	1·5 ,,	,, ,,
R.A.S.C. (*Buller Barracks*).		
Q (Recruits Coy.)	18·7 ,,	*Note.*—Under Barrack Treatment "C," A and Q show high proportion of N.C.O.'s—15 per cent of cases are N.C.O.'s. The strength of N.C.O.'s is much greater in these companies
P	3·5 ,,	
A	2·7 ,,	
Y	2·2 ,,	
A.S.P.T.	18·0 ,,	All are N.C.O.'s

NOTE.—Barrack Treatment Books show great variation and inconsistency of figures. Proportions between the companies and N.C.O.'s compared to Other Ranks are about the same as the hospital admissions, except as noted above.

The units are grouped according to formations in the approximate order of relative incidence, and the quarters occupied are shown. While extracting the lists, details of the company, squadron, battery, etc., were included in each case, and in Table A, where any marked differences in the incidence in subdivisions of the unit were shown, the details were included. It should be noted that the numbers for these subdivisions of units are total cases and not percentages, and allowance must be made for the relative strengths of these subdivisions. (As a rule headquarters is twice as strong as other companies.)

It will be seen that the average influenza rate for troops is over the five per cent mentioned by Cumming; while officers, including those engaged in tending the sick, show half this rate, the N.C.O.'s (excluding A.S.P.T.) only about one per cent.

Of the officers there were only thirty-four admissions, of which half were actively concerned in dealing with the sick in hospital and were engaged in nursing, and were probably infected in the usual droplet manner. (Note also the R.A.M.C. rate of twelve per cent for Nos. 1 and 2 Companies.) Of the 34 admissions, 23, or over 60 per cent, lived or fed in mess. Four R.A.M.C. officers living at home, on whom an actual check could be made, were on orderly duty and actually spent one whole day in mess, one to three days previous to the onset of illness. All these might well have been infected in the manner under consideration.

It will also be seen that certain areas came out more lightly than others; for example, Bordon (this is twelve miles away and a detention hospital is available), and Ewshott and Crookham (four miles away).

It will also be noticed particularly that one or two units stand out with excessively high rates of incidence and require special comment, and that there is a marked difference in the rates in contiguous and similar units. For example: Amongst the Cavalry, one regiment shows nearly double the incidence of its sister regiment; amongst the Artillery, two brigades occupying adjacent hutment barracks show an even greater difference, and amongst the Infantry in adjacent barracks, differences of 8·8 per cent compared to 4·0 per cent, and 14·9 per cent to 7·8 per cent, are seen.

As time and opportunity for investigations were limited, the investigation of methods of cleansing table utensils and of this possible link of infection as a cause for these differences was limited practically to pairs of units in each group, taking as far as possible the highest and lowest in each group, and units which are actually quartered next door to one another. The results are shown in a table of comparisons, Table B.

In carrying out these investigations effort was made to eliminate bias as far as possible from our mind and to note the actual facts and methods only, and to reserve a comparison of methods and their results with the known percentage of incidence until after the investigation. It would, of course, have been more satisfactory to have reversed the whole investigation and obtain details of methods before knowing the relative incidence, but time and opportunity did not allow of the prolonged investigation which this would have entailed. Detailed notes, giving the results of each examination of methods were jotted down at the time, and a summary of these is given as accurately as possible in the list of comparisons. In Table B, where there is a very marked difference of incidence in the subdivisions of a unit, the methods employed by the various subdivisions are also set forth.

When these investigations had been completed, opportunity was made to obtain the further figures of admissions for the month of March. It

was found that the figures of this second wave varied relatively little from those of the January to February period, and only in a very few cases did they alter the relative position of units within their group, or even the position of subdivisions of a unit. For example :—

In the Cavalry Brigade the order remained the same, the 7th Hussars having 12·4 per cent of cases and the 8th Hussars having 8 per cent, the Cavalry batteries remained in exactly the same order for the three months. In the Guards Brigade the order and relative proportions remained unchanged. In the other Infantry Brigades no change was found except a crop of cases in the Beds and Herts Regiment from Bordon which could not be followed up. In other units no change occurred.

The proportion of N.C.O.'s was even less than before, being four out of 133 cases.

This constancy of relative incidence in March compared with the earlier months is of interest and importance, as it shows that the relative incidence in units has remained unaffected even after preventive measures concerned with spacing, temperature, ventilation and disinfection in institutes had been carried out.

As the investigation proceeded, the impression acquired as to the relation of methods of washing table utensils to incidence rates was that the more the methods of washing approximated to the use of actual sterilization with boiling water, the less was the influenzal rate in the unit concerned, or rather, that it was in those units with a low incidence of influenza that the methods most closely approximating to actual sterilization would be found; and conversely, the units with a high rate of incidence were the ones which used the conventional bucket or tub of so-called hot water for washing the chief table utensils.

An examination of the table of comparisons appears to confirm this mental impression and to indicate that a definite relationship exists. There are, of course, exceptions which do not appear to comply with this and which are difficult to explain on these grounds only, and it is not proposed to attempt to bias opinion by attempting to explain them away on other grounds, beyond indicating a possibly obvious cause of difference, such as "Q" Company of the R.A.S.C., or the Mounted Depot of the R.E., both of which contain a high proportion of recruits.

There are several points which should, however, be noted in relation to Cumming's data and findings. In these British units, with very few exceptions, the knife, spoon and fork and usually the mug or cup, are the personal property of the individual man who alone uses and cleans them. Plates, and sometimes mugs, are usually mess property and are washed collectively. If table utensils are a route of infection, it appears to be less likely that saliva infection will actually be conveyed by plates, and more likely that the knife, spoon and fork, and particularly the mug, will be the conveyer. If these are always personal property and only used by the particular individual, then it would appear to follow that it is the method

by which they are washed which is the important one, i.e., is the washing material going to pass on infection from one set to another, or is it going to render each set sterile or nearly so?

An examination of Table B appears to show that where the conventional bucket or tub of certainly lukewarm water is used for these utensils, a higher rate of incidence is found, and that it is in the units with lower rates of infection that other methods are used. This difference of method may consist in the use of really hot water under a tap, or a copious supply of fresh water as in "F" Battery, compared with "D" and "M" batteries; or it may be that no arrangements appear to be provided on the spot, and each man takes his articles away and washes them under a separate cold water tap in the barrack wash-house, as in the Coldstream Guards.

TABLE "B."

COMPARISONS BETWEEN CLASSES OR GROUPS ACCOMMODATED IN SIMILAR OR ADJACENT BARRACKS.

Comparison of Rates of Infection and Washing Methods.

Officers.—Majority living in own houses and therefore not subject to this line of infection.
Rate.—2·5 per cent; excluding medical officers, 1·3 per cent.
Over 60 per cent lived in messes, but adequate washing arrangements were usually available.

N.C.O.'s (Corporals upwards).—Majority married, but many feed in messes. Really hot tap-water available in all N.C.O.'s messes which were investigated.
Rate.—1·1 per cent.

Other Ranks.—Practically all live in messes—5·5 per cent.
5·6 ,, (includes March figures).

Cavalry Brigade – Wellington Lines (three regiments in adjacent barracks).

7th Hussars	.. 11·6 per cent	Majority wash in a bowl at the door
5th I.D. Guards	.. 8·0 ,,	Majority wash in a bowl in the room. "Pinkie" used
8th Hussars	.. 6·1 ,,	Wash in sink directly under hot (boiling) tap. "Pinkie" used
Royal Horse Artillery	6·9 ,,	3 batteries form 1 working unit, but feed separately
"D" Bty.	14 cases	Wash in bucket of hot water at the door. "Pinkie" used
"M" ,,	14 ,, ...	Wash in bucket of hot water at the door. "Pinkie" used. Boiler large and insufficient coal
"F" ,,	2 ,, ...	Wash in sink under very hot tap. "Pinkie" used

The strengths of "D," "M" and "F" Batteries are approximately equal

7th Hussars.

"B" Squadron.	32 cases.. ..	Wash in a bowl at the door
"A" ,,	19 ,, ...	Hot water in bucket at the door
"HQ" ,,	4 ,, ...	Wash in a bowl in a sink under very hot tap
"MG" ,,	6 ,, ...	Wash under hot tap in sink

Guards Brigade. Stanhope Lines. (Contiguous barracks.)

Scots Guards	.. 7·9 per cent	Wash in a bowl at the door or in wash-house
Coldstream Guards	4·7 ,,	Taken away and washed in wash-house, or under a hot tap

Marlborough Lines. Adjacent Barracks.

King's Regt.	.. 8·8 per cent	All companies: Utensils washed in a tub of water at the door, brought from the cook-house
Loyal Regt.	.. 4·0 ,,	Central washing directly under very hot taps, water often boiling

TABLE "B" (*continued*).

Wellington Lines. Adjacent Barracks.		
R. Berks. Regt. ..	8·7 per cent	Majority have a bowl of hot water or a tub at the door of dining-room
		(Company strengths are HQ 135, MG 85, Other Companies 40 actually present)
		HQ 10 cases, C Coy. 9 cases, MG 5 cases, A Coy. 5 cases. All use a bowl of water at the door of dining-hall
		B Coy. 2 cases. Wash directly under the hot tap and use "Pinkie"
K.S.L.I.	4·5 ,,	Very hot water from boiler; often too hot for hands; use "Pinkie"
Blackdown Barracks. *Central collective dining-rooms.* Adjacent Barracks.		
Suffolk Regt. ..	14·9 per cent	Electric washers with hot running water for plates and mugs. Knives, forks and spoons washed in two sinks with hot tap at doors, but N.C.O. states this water is never very hot in these taps
(Note.—M.O. i/c states this unit always has many sick.)		
Somerset Regt. ..	7·8 per cent	Exactly the same arrangements as above, but N.C.O. states water is changed every 30 plates; and water in sinks at doors for knives, spoons and forks changed frequently
These two units use the same N.A.A.F.I. Institute.		
R.A.M.C.		
No. 1 and 2 Coys.	12·0 per cent.	Engaged at the hospitals nursing cases
Depot	2·4 ,,	Training establishments at Crookham, 4 miles away and have 70 per cent recruits
R.A.S.C.		
"Q" Coy.	18·7 ,,	"Q" Coy. is the Recruits Company (nearly 400 raw and young to military life). It is said that there was overcrowding. Ten days after epidemic started, stringent orders as to sterilization of crockery and cutlery were brought into use. Washing under hot taps in sinks is now the method in use for all from a central mess
Other Coys... ..	3·2 ,,	
A.S.P.T.	18·0 ,,	All are N.C.O.s
		Central messing with collective crockery and cutlery.
		Central washing in tubs in the dining hall. Hot water carried from kitchen
R.A. Deepcut Barracks. Adjacent Barracks.		
4th Light Bde. ..	9·2 per cent	Majority wash utensils in bucket of hot water carried from the cook-house
10th Fld. Bde. ..	3·7 ,,	Majority wash utensils in wash-house under tap or in sinks. Water mentioned as too hot for hands
4th Light Bde.		
21st Bty. 16 cases..	.. ..	Tub of hot water changed three times. N.C.O. supervises
15th Bty. 12 cases..	.. ..	3-gallon bucket of water carried from cook-house and cold tap into sink
20th Bty. 6 cases..	.. ..	3-gallon bucket of water changed four times direct from boiler
R.E. Stanhope Lines.		
Mounted Depot.	11·9 per cent.	Feed in double shifts. Washing stated to be individual in sink under hot tap, but a bucket and a tub standing on the floor seemed to be the actual method
5th Fld. Coy.	5·0 ,,	3-gallon bucket of water with soda at the door of dining-room
23rd Fld. Coy.	1·6 ,,	Hot bucket at the door changed three times
26th Fld. Coy.	1·6 ,,	Washed in sink under running hot tap
11th Fld. Coy.	1·5 ,,	Hot tap and sink and bucket at door of wash-house

It was found that actual sterilization in water, maintained boiling over a stove, was carried out in practically every N.A.A.F.I. canteen after the first ten days of the epidemic (in the majority of cases this was actually seen in use), in accordance with orders issued on the subject.

But in no case in men's messes was a receptacle on a fire used for

actual washing, after the manner indicated by Cumming, the nearest approach being a sink with a hot tap supplied from a special boiler. In many cases this water can be little short of boiling and is certainly adequate for killing off all salivary organisms. It is noticeable that it is those units which use plenty of really hot water in the process of washing these table utensils which show a low incidence rate for influenza. Some of the exceptions are difficult to account for; for example, at Blackdown Barracks two units with nominally similar arrangements have markedly different incidence; or again, the R.A.S.C. units all use exactly the same method and yet show a difference of 16 per cent incidence; or again, R.E. units, those with the better method showing a higher incidence. Of course, in these units the variation may be due to the other routes of infection, such as overcrowding, etc., but these points were not investigated.

That the table utensils are the only method of spread of this epidemic is far from being a fact, but they may have played their part in individual units. The epidemic was a generalized one in the district, affecting many civilians and showed no regular sequence of spread from one group of barracks to another. A detailed examination of Table B brings the following contrasts forward for consideration and appears to favour a relationship of low incidence with the more adequate methods approaching sterilization which would obviate this route of infection.

Of the cavalry regiments, the 7th and 8th Hussars are units in contiguous barracks, leading the same life, of about the same strength, doing similar work and equally close to the town of Aldershot, yet the former shows nearly double the incidence of the latter which uses more adequate methods of crockery sterilization. The contrast in the subdivisions of the 7th Hussars brings out this difference to a marked degree. The two squadrons using the better method have a quarter and a fifth of the number of cases of the other two.

In the R.H.A. a yet more astonishing difference is shown. The three batteries are practically identical in size, work, housing, etc., and in fact form subdivisions of a major unit. The difference arises in their messing arrangements, and it is seen that the battery which uses the best method of table utensil washing shows two cases for three months as against fourteen cases each for the others.

In the Guards Brigade, the two sister units also show a difference, but in this case the smaller incidence in the Coldstream Guards appears to be due to the fact that in several of the messes no special washing arrangements are made; each man takes his articles away and washes them under a cold tap in the barrack wash-house, and very strict discipline ensures that they are clean. The method does not sterilize utensils, but eliminates the lukewarm link of the dining-room wash-bowl.

In Marlborough Lines, again, a distinct difference was found between the two units chosen, the highest and lowest in the list. In the former we find the typical lukewarm washing in vessels in the room, as against the central washing under specially good arrangements in the latter. The units are in

adjacent barracks and under similar conditions, but the Loyal Regiment is rather under strength and bed-spacing, etc., may have been more efficient.

In Wellington Lines also, there is found the typical tub-at-the-door method in the one case, with an influenza rate of 8·7 per cent, contrasting with 4·5 per cent of the next-door unit, where much hotter water is used. The units are practically similar and occupy the two halves of one block of barracks and share the same N.A.A.F.I. canteen buildings. In the former unit also, the case of one company, which is lucky enough to have direct access to the hot-water pipe supply, stands out in marked contrast to the other companies.

In the Blackdown Infantry Barracks—four miles away—with such different rates as 14·9 per cent compared with 7·8 per cent, one expected to find some marked contrast in washing-up arrangements. The arrangements are, however, nominally identical and represent the most up-to-date methods. Close inquiry, however, seemed to show that in the former case, really hot water was not used in the knife, spoon and fork washing, and also there was some difficulty over a sufficiency of fuel.

Amongst the R.A.M.C., we also see a marked difference—12 per cent for Nos. 1 and 2 Companies and only 2·4 per cent for the Training Establishment. The latter contains some 70 per cent of recruits and might well be expected to show similar results to "Q" Company, R.A.S.C., or to the Mounted Depot of the R.E.'s. It is the 1 and 2 Companies, however, which give the high incidence, and in this case infection is undoubtedly through close contact and droplet infection when engaged in nursing duties.

The huge difference in the companies of the R.A.S.C. certainly does not appear to be attributable to the utensil-washing route. All companies use the same method and a very hot washing water was seen in use.

Amongst the Gunners at Deepcut we get the two contrasts: the first being between the two brigades and the second between the batteries of the most infected brigade, with their differences of method and corresponding difference of infection rates.

The R.E. units, on the other hand, show a variation in incidence which was not fully explained by variation in methods of washing, and some other factor, not ascertained, must have been the cause.

Summary.

On the whole, however, this investigation appears to warrant the following conclusions :—

(1) That there does appear to be a definite relationship between the more adequate methods of washing of table utensils, approaching sterilization by boiling water or steam, and a low rate of incidence of influenza.

(2) That this route of utensil-washing plays a very considerable part in the spread and prevalence of the disease, and that droplet infection may not be the main line of spread, as the infection continued in the same relative proportions in March after the usual preventive measures had long been in force. Consequently, prevention should be directed against this route.

(3) That the conventional method of supplying a bucket of lukewarm water, even when "pinked" with dilute potassium permanganate, for the washing of knives, spoons, and forks is dangerous, and should be replaced by an adequate method.

(4) That the provision of a sterilizing method of washing utensils is required in each unit to reduce the incidence of such epidemics. Such methods require a certain amount of special apparatus and probably extra fuel.

(5) That such adequate methods, even if not always in force, should be brought into use at the beginning of each winter before the usual increase in salivary-borne diseases.

If it is considered that the above conclusions are correct, then improved methods of utensil sterilization are certainly required, and the following suggestions are put forward:—

Where a boiler and hot tap-water supply of any kind whatsoever is available in proximity to the mess rooms, arrangements should be made to carry out all the utensil-washing under that tap, even if it means every man having to be allowed into the wash-up rooms. The provision of adequate fuel to maintain a really hot-water supply at all required times is essential.

If there is no boiler, braziers on which the wash-buckets can stand in easily accessible places should be provided. Any extra expense is difficult to meet in these times, but braziers can be made cheaply, or they may be improvised from five-gallon oil drums at exceedingly small cost. Here again the provision of some extra fuel will need consideration.

Alternatively, an improvised crockery steam sterilizer could be made at very small cost, using a five-gallon oil-drum as the steamer and a simple petrol drum boiler over an oil-and-water fire.

A full description of this sterilizer will be given in a separate communication.

By means of this sterilizer, all crockery and cutlery can be steamed *in situ* on the tables in the wash-up room, or very hot water can be readily made available. No special personnel or skill is required and fuel expenditure is limited to about three-quarters of a gallon of crude oil per hour of steaming. Steaming only takes a short time—three minutes for forty plates—and all the crockery is dry at the end of the operation. Starting and stopping consume little fuel. Complete sterilization is secured.

My thanks are due to Major-General J. A. Hartigan, C.M.G., D.S.O., K.H.P., D.D.M.S., Aldershot Command, for permission to carry out this investigation, and to Lieutenant-Colonel W. C. Smales, D.S.O., O.B.E., R.A.M.C., for assistance, and to Lieutenant-Colonel G. S. Wallace, O.B.E., R.A.M.C., for assistance and guidance in carrying out the investigation and adapting the sterilizer.

REFERENCES.

[1] CUMMING, J. G. "Saliva-Borne Disease Control; Eradication," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, lvi, No. 2, 101, February, 1931.

[2] LOW, Lt.-Col. N. "Control of Saliva-Borne Disease," *ibid.*, lvi, No. 2, 157, February, 1931.

THROMBO-ANGIITIS OBLITERANS.

By Major S. SMITH,
Royal Army Medical Corps.

Thrombo-Angiitis Obliterans, or Buerger's disease as it is called in America after Leo Buerger who first described the condition as a clinical entity, is a disease of almost universal distribution, particularly common in our army, apparently attacking all ranks with true democratic impartiality.

As at present described, Buerger's disease would appear to represent a syndrome or symptom-complex rather than one disease process, and many consider that various causal agencies may be at work in different cases.

It is a curious fact that, whereas the series of cases originally described by Buerger was limited exclusively to Jews of Polish, Roumanian, or Russian nationality, and the disease was considered by him to be limited to that race, further research has shown its incidence to be world wide, and typical examples of the disease have been described as occurring amongst non-Jews of many races and creeds, including Gentiles, Koreans, Chinese, Japanese, etc.

Some authors have attributed the arterial changes underlying the syndrome to an inflammatory process; one observer has even described a specific organism, which (in his hands) is said to fulfil most of Koch's postulates; others consider that the disease is degenerative from the start, the condition being a localized form of arterio-sclerosis (athero-sclerosis); whilst still others have sought to invoke some metabolic dyscrasia as a cause, and claim to have found abnormal metabolites, or normal metabolites in abnormal quantities, circulating in the blood in certain cases.

Whilst the symptomatology and course of the disease are fairly well defined, thanks in the first place to Leo Buerger's researches, treatment remains probably its most unsatisfactory feature; most, if not all, of the more severe cases progressing to a condition of gangrene of one or more limbs, necessitating amputation as a life-saving measure and for the relief of unbearable pain, no matter what interim remedial measures may have been undertaken in an attempt to stay its course.

There is an aphorism, "Man is as old as his arteries"; an equal truism is that "a limb is as old as its arteries"; when the arteries die or become functionless, the limb soon follows suit.

Historical.

Cornil and Ranvier as long ago as 1860 described "Obliteration des Artères par endarteritis et thrombose," and pointed out that a coagulum may precede arteritis as well as arteritis precede a coagulum.

The clinical characters were first described by Winiwarter in 1879, long before Leo Buerger [1] of New York, in 1908, first described thrombo-angiitis obliterans as a clinical entity occurring amongst Polish and Russian

Jews, and published in 1924 his classical book dealing with the circulatory disturbances of the extremities [2]. The appearance of this publication has stimulated world-wide interest in the disease which bears his name, and excellent descriptions of cases with pathological findings, occurring in non-Jews, have been published by De Courcy Wheeler [3], Smith and Patterson [4], Telford and Stopford [5], Cawadias [6], Parkes Weber, Rast and Lutteroti [7], Priest [8], etc., while Meleney and Miller [9], have recently described the occurrence of the typical syndrome in a series of twenty-five Chinese.

It is from the above-mentioned publications that much of the material for this paper has been drawn.

Causation.

Little is known, much conjectured, concerning the causation of this obscure but far from rare disease.

It is not even known if the thrombosis precedes the endarteritis or vice versa. In other words, are we dealing with a primary arterial thrombosis followed by secondary changes in the arterial walls, a kind of disuse atrophy; or are the changes in the arterial wall, especially in the intima and internal elastic layer, primary, with thrombosis as a secondary event?

It is known that, under certain conditions, section of the sympathetic nervous system produces a condition of endarteritis in the limb supplied by that portion of the sympathetic.

Lapinski [10] cut the cervical sympathetic in rabbits and showed that the arteries of the ear presented endarteritis obliterans, fragmentation of the internal elastic lamina, and hyperplasia of the media, a pathological triad commonly met with in Buerger's disease.

It has recently been discovered (Hunter and Royle) that the vessels of the limbs receive a dual supply of sympathetic fibres [11], firstly from the nerve plexuses on the aorta and large vessels, and secondly from the mixed peripheral nerves.

It may well be that the poor response of cases of Buerger's disease to Leriche's periarterial sympathectomy is in part explained by failure to recognize this dual supply.

Recently, Adson [12] of Rochester, U.S.A., claims to have obtained improved results by lumbar sympathectomy combined with periarterial stripping of the external iliac vessels, thus ablating the whole of the sympathetic nervous supply to the limb.

All this work is suggestive and, whilst leaving unanswered the question of the primary and inciting cause, indicates a close connection between thrombo-angiitis obliterans and some mal-function of the sympathetic nervous system, whatever the lesion, inflammatory, endocrine or metabolic, underlying the latter may be.

In this connection it is interesting to note that Dr. Adolfe Abrahams

[13] has stressed the frequency of diseases of the sympathetic nervous system amongst Jews.

Most writers attribute the condition to an inflammatory lesion and cite the giant-cell systems seen in the organized and organizing clot, and round-celled infiltration met with in all the arterial coats, and the very noticeable peri-arteritis and peri-phlebitis, as sure signs of inflammation.

Telford and Stopford [5], in summing up the histological changes met with in four cases described by them, all of which progressed to amputation, found that " they are those of a chronic inflammatory lesion and suggest a microbic origin."

Rabinowitz [14] claims to have isolated a Gram-negative, rod-shaped and beaded organism from lesions of the disease, and by inoculation of this bacillus to have produced the same lesion in the feet and ears of rabbits. I am unaware if this work has been either corroborated or refuted by other workers.

Cawadias [6], on the other hand, looks on the disease as essentially metabolic in origin. He describes certain *external* factors, of which tobacco intoxication, infection and emotional stress are the most important; and, as *internal* factors, the constitutional inadequacies of certain " regulators of metabolism," chief amongst which are the pancreas, adrenals and sympathetic nervous system. He considers that, whilst the disease is primarily due to the above-mentioned constitutional inadequacies (or their faulty balance), the actual sites of the lesions are determined by local infections of the arterial wall (due to typhoid, typhus, syphilis, possibly focal infections).

He describes three phases: (1) Pre-arteritic phase of metabolic disturbances; (2) incompletely obliterating arteritis; (3) thrombo-arteritis.

During the pre-arteritic phase there is a condition of hypercholesteræmia, due to the above-mentioned metabolic deficiencies.

Cawadias further states it to be his opinion that endarteritis obliterans, of which thrombo-angiitis is a special variety, should be looked on as one form of athero-sclerosis (arterio-sclerosis of most authors). In some cases described thrombo-angiitis obliterans has been found in conjunction with coronaritis and endarteritis of the mesenteric vessels, and angina pectoris, which he considers as due to obliterative endarteritis of the coronary vessels, has been called " intermittent claudication " of the heart.

Most writers are agreed that *tobacco* intoxication is an important ætiological factor. Dixon [15] has divided the circulatory disturbances secondary to the " tobacco habit " into two main categories:—

(1) Those causing no inconvenience to the subject. Chief amongst these are slight acceleration of the heart and increase in blood-pressure.

(2) Those giving rise to inconvenience in susceptible individuals. Amongst the latter he mentions: (*a*) Palpitation, arrythmia; (*b*) anginoid

pain associated with *vaso-motor* disturbances; (c) *arterio-sclerosis*, easily produced in animals; no proof, except possibly indirect, of a corresponding condition in man.

In conclusion he states, "There is an increasing impression amongst clinicians that the insidious action of nicotine spread over many years of continuous absorption is responsible for at least some of the cardio-vascular diseases so common in middle and late life."

This, if it includes thrombo-angiitis obliterans, I consider to be a fair exposition of the present-day belief; and, while, if tobacco were the sole cause of Buerger's syndrome, one would expect to see other signs of intolerance such as tachycardia, amblyopia, etc., excessive smoking (especially of cigarettes) has occurred in too great a proportion of cases for it to be entirely overlooked as an ætiological factor in at least some cases. It must be remembered, however, that typical cases of the disease have been described in non-smokers.

With regard to syphilis as a possible causative factor, the position is entirely different. Only a small proportion of cases have had positive Wassermann reactions, and, as far as I know, the spirochæte has never been demonstrated in the characteristic lesions.

Two typical and interesting examples of thrombo-angiitis obliterans have been described in syphilitic subjects [4], but the authors have been at pains to point out that the arterial lesions in these cases were not characteristic of syphilis, nor were spirochætes found in the lesions; they regard the association of the two diseases as fortuitous.

Histology.

The following brief account of the histology of the disease is abstracted from Telford and Stopford's [5] description of the histological changes met with in the arteries in four typical cases described by them.

"The changes described closely correspond to Buerger's description of his series. At the outset there is a lymphocytic invasion of the coats of the arteries and veins. The cells are replaced by fibrous tissue and new vessels may be seen extending through the adventitia to the media. Whilst these changes are proceeding parts of the lumen become occupied by clot, which is gradually organized. In the obliterating connective tissue a number of small channels are to be found, which have a lining of endothelium, and, surrounding this, some possess a thin coat of smooth muscle. After the thrombosis has occurred, and whilst organization is proceeding, collections of lymphocytes not unlike tubercles often make their appearance and persist until they are replaced by fibrous tissue. There is commonly some irregular thickening of the intima, but, as a rule, only very slight proliferation or fibrillation of the internal elastic lamina. At a later stage the fibrous tissue in the lumen has a denser appearance, but this may be due, at any rate, partly to the contraction of the newly-formed fibrous tissue in the media and adventitia, which not infrequently shows

hyaline or other degenerative changes. This contraction may be an important factor in the production of gangrene, since it leads to compression and occlusion of many of the newly formed small channels in the connective tissue in the lumen. The histological examination indicates that the disease is much more widespread than the clinical picture would suggest, both superficial and deep arteries being involved, but all the vessels in one region are not equally affected. . . . There is no evidence to suggest that the disease is secondary to any affection of the peripheral nerves."

Cawadias [6], in his description of the histological changes met with in this disease, which he believes to be one variety of endarteritis obliterans, itself a result of athero-sclerosis, considers "the initial and principal phenomenon to be a proliferation of the intima; the lamina elastica interna is often divided, and the involvement of the other coats is late, inconstant and atypical. The proliferation of the intima causes narrowing of the arterial lumen."

The exact relationship of thrombo-angiitis obliterans to arterio-sclerosis (athero-sclerosis) is uncertain.

Geoffrey Evans [16] describes the latter disease as "characterized by a pathological thickening of arterial coats, especially the intima; inflammatory reaction is of the first importance, degenerative changes an essential part of the picture; hyperplastic and involutionary changes also play a part."

From the "no-man's land" of arterio-sclerosis he "buds off" certain forms of arteritis of which the ætiology is known, such as tubercular and syphilitic arteritis, and other definite clinical entities of doubtful ætiology, such as thrombo-angiitis obliterans and arteritis nodosa.

The chief ætiological differences between the two diseases would appear to be that, whereas in arterio-sclerosis the changes are commonly associated with senility, hypertension, and syphilis, in Buerger's disease the onset is usually pre-senile (average age of onset thirty years), syphilis is not commonly associated, and there is in some cases a tendency to hypotension; other important differences are the tendency to thrombosis and involvement of the veins in the sclerosing process.

These differences would appear to be fundamental and point to very different ætiological factors at work in the two diseases.

Ætiology.

Whilst early writers, notably Leo Buerger, have stated that thrombo-angiitis obliterans is confined to the Jewish race, especially those of Polish, Russian or Roumanian nationality, later workers have shown that Gentiles are equally liable to attack, in fact recent reports have dealt almost exclusively with its incidence amongst Christians and other non-Jewish races.

Meleney and Miller [9] have collected a series of twenty-five cases occurring amongst Chinese in China, where, they say, the disease is common. They came to the following conclusions:—

"(1) Thrombo-angiitis is found extensively in China amongst the Chinese.

"(2) The process appears to be an inflammatory one, attacking the large and small arteries and veins in an irregular manner and causing thrombosis and obliteration. It is not necessarily progressive either from below upwards or from above downwards.

"(3) The nutrient arteries of the nerves are frequently the site of the process. This may in some manner explain the severe pain which is constantly associated with the disease.

"(4) An extensive collateral circulation develops as a result of the blocking of blood-vessels, as is shown by X-ray photos of injected vessels. In some cases this collateral development can keep pace with the obliterating process and maintains the circulation; in other cases it cannot keep pace with it, and then more or less extensive gangrene develops."

Silbert and Samuels [17] have studied 124 cases of thrombo-angiitis obliterans with Pachon's oscillometer, and have come to the conclusion that smoking is the main ætiological factor and that the disease is much more common in America than Western Europe.

Parkes Weber [18], in an early paper, describes the condition as "non-syphilitic arteritis obliterans of Hebrews," but recently he has seceded from this attitude and has reported two typical cases occurring in Englishmen with no Jewish ancestry [7]; he gives it as his opinion that the disease is economic rather than racial [13].

Even this view is open to attack as Priest [8] has recently reported two typical examples of the disease in officers of the British Army. Reports of Buerger's disease occurring amongst Turks, Koreans, and Japanese have also appeared.

No age period appears to be exempt, though there is a special liability for the onset to be noted during the third decade.

The disease is almost completely confined to men (ninety-nine per cent of Buerger's cases), and the lower limbs are much the most commonly affected; fifty-two per cent of Buerger's cases progressed to amputation of one or more limbs.

Buerger [19], in his classical account, describes four types according to the distribution of the lesion and age of onset: (1) Typical form in the lower extremities; (2) the same with associated thrombo-phlebitis; (3) the same with involvement of the upper extremities; (4) a form in more senile patients complicated by arterio-sclerosis.

As indicated above, a rational classification of the various forms of arteritis based on their histological appearances is thought by many to be impossible; many different causes may produce approximately the same lesion.

Leibovici [20] has classified arteritis according to the various age-periods:—

(1) Juvenile, under 40, most cases of Buerger's disease fall into this group; (2) pre-senile, 40 to 50; (3) senile, over 50.

This classification is, of course, unscientific and not permissible except as a temporary expedient.

Symptomatology.

The most characteristic symptoms of thrombo-angiitis obliterans are :—

(1) *Pain* in the affected limb or limbs, usually the lower extremity.

(2) The characteristic symptom of *intermittent claudication.*

(3) Absent pulse in one or other arteries of the foot (usually dorsalis pedis artery).

The pain is usually, in the early stages, non-characteristic and may amount to little more than "rheumatic twinges." On this account most cases are first diagnosed gout, myalgia, rheumatism, fibrositis, etc.; in the Army "flat-foot" is a common early diagnosis.

In many cases it is only later, when the true nature of the disease is suspected, that a history of intermittent claudication is obtained, often only as a result of careful questioning.

On the other hand, the onset may be absolutely sudden, as occurred in a patient of mine, who complained of sudden *acute* pain in his left thigh whilst playing hockey, sufficiently severe to cause him to vomit, and which necessitated his being taken off the field; in due course he developed the characteristic syndrome.

Absence of pulsation in one or other artery of the foot, or in the radial artery if the upper extremity is first affected, may be a very *early* sign, and in certain cases be only discovered on routine examination prior to the onset of the characteristic symptoms; in some cases, too, arterial changes may be far advanced in the clinically symptomless leg, while the patient complains of pain, etc., in the other, in which a pulse may still be obtained.

Whilst loss of pulsation in one or other of the small arteries of the foot may be, in conjunction with other signs and symptoms, of ominous significance and of great diagnostic and prognostic importance, it must not be taken as axiomatic that every patient with an absent pulse in one or other of these arteries is necessarily suffering from thrombo-angiitis obliterans, even if he complains of rheumatic pains in that limb.

In order to ascertain in what percentage of normal individuals absence of pulsation in one or other of the above-mentioned arteries is to be found, a careful examination of the feet was made of 100 hospital patients (soldier patients for the most part suffering from minor ailments); we were surprised to find complete absence of pulsation in either the dorsalis pedis or the posterior tibial artery, or in both, in no less than thirty-two, and in a further seventeen the artery could only be palpated after prolonged search.

In two of the above, both free from symptoms, no pulsation was felt in any of the four arteries of the two feet.

Thus, in only 51 per cent of those examined was a good strong pulse to be felt in all four arteries of the feet.

None of the thirty-two patients mentioned above suffered from symptoms in any way suggestive of Buerger's disease, although conceivably, a small proportion might be in the "Pre" thrombo-angiitis stage and develop symptoms at some future period.

Certain ætiological factors, such as daily cigarette consumption (12·9), average age (25·7 years), systolic blood-pressure (121·1 mm. of Hg) were noted in the above groups and compared in these respects with a control group of 100 individuals; the corresponding figures in respect of the latter were: average daily cigarette consumption 13·6, average age 25·3 years, average systolic blood-pressure 120·1. Thus no very startling differences between the two groups are disclosed.

Intermittent claudication is, when present, a very characteristic symptom, and, as its name implies, consists of an intermittent limp or sudden halt, due to, and accompanied by, pain, often severe, and complained of after walking a certain distance.

Intermittent claudication is not, however, confined to cases of thrombo-angiitis obliterans, and may be associated with any form of obliterative endarteritis of the lower limbs, causing ischæmia.

This symptom, at its onset, usually follows some sudden effort, as in the case quoted below (Case 3), and the pain may, in the first place, erroneously be put down to a "twist" or sprain, until succeeding attacks cause one to seek another diagnosis.

At first only occurring after prolonged or unwonted effort, the painful limp gradually follows less and less exertion until finally the patient is unable to walk even a few yards for fear of provoking it, and in consequence becomes bedridden or anchored to his chair.

In this respect intermittent claudication closely resembles angina pectoris, which has been called "intermittent claudication of the heart," a graphic and accurate description in the opinion of those who attribute the latter disease to obliterative endarteritis of the coronary artery (coronaritis).

In addition to intermittent claudication the patient may suffer from constant pain in the affected limb or limbs, which, commencing as an indefinite "ache," may develop into almost unbearable agony, destroying his sleep at night and reducing him to a mental and physical wreck, so that he seeks relief at any cost, even that of amputation, which is often quite rightly performed for this symptom alone.

Other less striking and constant symptoms of this distressing disease are:—

(1) An angry red discoloration of the foot (a form of erythro-melalgia), often accompanied by slight puffiness of the toes when the foot is allowed to hang in the dependant position.

(2) Various trophic changes: trophic ulcers, localized gangrene, etc.

(3) Blanching and coldness of the foot in the horizontal position.

There is in some cases a marked tendency to periodic *remissions* and *relapses*, which suggests that the causative agency, whatever it may be, produces in the first place an intermittent arterial spasm which only progresses to permanent changes in the artery wall and lumen after the lapse of a considerable period (another possible explanation is that the remissions are due to the production of a temporarily efficient collateral circulation).

Other cases progress steadily to gangrene of one or more limbs necessitating amputation as a life-saving measure.

Many other symptoms such as myokymia, anæsthesia, paræsthesia, etc., have been described in individual cases, but are not of sufficiently frequent occurrence to merit more than a passing note.

Description of Cases.

During the past four years I have had three undoubted cases of thrombo-angiitis obliterans, occurring amongst soldier patients, under my charge. In addition, a short description is given of a fourth possible case (Case 4), who may or may not eventually develop the complete syndrome; time alone will tell.

Case 1.—Signalman H., religion C. of E., aged 31, was admitted to the Royal Herbert Hospital, Woolwich, on January 19, 1927, suffering from localized gangrene of the toes of both feet.

Prior to joining the Army four years previously, he had served in the Baltic Seas as a sailor for a prolonged period. He denied syphilis and his Wassermann reaction was negative; he was a heavy cigarette smoker.

There was a history of an injury (crush) to the right foot in 1923, followed by a septic condition of the toes of that foot which slowly but eventually healed.

Local gangrene of one toe of the right foot occurred in 1924, followed two years later by a similar condition of the toes of the left foot.

On examination, several toes of both feet were noted to be missing (amputated); there was moderate swelling of the dorsum of both feet; the dorsalis pedis artery was not felt to pulsate in either foot.

No progress was made during a prolonged stay in hospital, and he was eventually invalided from the Army.

There was no history of intermittent claudication in this case.

Case 2.—Pte. A., religion C. of E., aged 31, was admitted to the Royal Herbert Hospital, Woolwich, on September 17, 1926, complaining of pain in the right foot and calf.

Prior to joining the Army eight years previously he had served in the Baltic Seas as a sailor.

He had been admitted previously for rheumatism, when he complained of pain in his right foot and was noted to have an erythematous rash on his right shin: there was a recent admission for "flat foot."

For the past few months he had suffered from aching pain in the right foot and calf muscles, the latter aggravated by walking, so that he had to

stop after walking some two hundred yards. He admitted to syphilis in 1918, but several blood tests since then had been negative; he drank more beer on occasion than was good for him and was a moderate (pipe) smoker.

On examination, there was found to be a zone of bluish discoloration covering the two outer toes and the tip of the great toe of the right foot. No pulse was to be felt in the right dorsalis pedis artery, a strong pulse in the left. The posterior tibial pulse was not felt in either foot. There was slight œdema of the right foot and leg, stretching half-way up the calf. A trace of sugar was noted in his urine on one occasion only; the Wassermann reaction, repeated after a provocative injection of salvarsan, was negative.

An irregular, cord-like structure was felt in the position of the right internal saphenous vein; this was cut down on and a portion removed for microscopic examination. On section, it proved to be a much-thickened section of vein, the adventitial and medial coats being chiefly affected; the lumen was narrowed and filled with organized clot.

Improvement appeared to follow the continued application of ultra-violet rays to the right foot; a slight return of pulsation in the dorsal artery of the foot being accompanied by a slight alleviation of symptoms.

He was finally invalided out of the Service after five months' observation in hospital.

The above two cases presented the following interesting features in common: both had previously been sailors and both had served during adolescence in the Baltic Sea where vitamin-containing foods were in all probability markedly deficient.

Case 3.—Pte. P., aged 27, was transferred to the British Military Hospital, Murree, from a frontier station on June 21, 1930. There was a history of persistent malaria (benign tertian). Aching was first noted in the right arm in 1927 and had recurred periodically ever since. Whilst playing hockey in June, 1929, he was seized with sudden acute pain in the left thigh, sufficiently severe to make him vomit, and he had to be carried off the field; the acute pain soon left him but was followed by a dull ache which has persisted. For two months prior to admission to hospital he had suffered from pain and cramps throughout the whole of the left leg, especially the foot; the pain was aggravated by exercise, and after walking a short distance he was compelled to stop on account of it.

About the same time the left leg and foot were noted to be colder than the right and he noticed a constant tingling sensation "like pins and needles" on the dorsum of the foot and a burning sensation in the sole.

In addition to the constant dull ache in the right arm he suffered from attacks of local syncope of the fingers of the right hand.

The true nature of his illness was not appreciated at this time, and as he was a regimental nursing orderly and considered to be hypochondriacal, his symptoms were considered to be largely "functional."

There was no evidence of any disease in the family; he was a teetotaller and smoked about twenty to thirty cigarettes a day.

He had never been a sailor but had "knocked about" the world a good deal and had worked for ten years on a farm in Australia.

There was no history of syphilis and the Wassermann reaction was negative.

On transfer to Murree he was noted to be very pale, of moderate physique, and intelligent. He struck one as belonging to the "vaso-tonic" class of individual.

The systolic blood-pressure was 120 mm. of Hg.

The right *radial* pulse could scarcely be palpated, in marked contrast with the left, which was full and bounding. Both radial artery walls were unduly palpable; the left brachial artery was felt as a pulseless cord, a normal pulse being felt in the axillary artery.

The left dorsalis pedis and posterior tibial arteries were not felt to pulsate, in contrast with the corresponding arteries of the right foot in which a strong pulse was felt.

All voluntary movements of the left leg were weak, especially plantar- and dorsi-flexion of the foot; marked loss of tone was noted in the left calf muscles.

The left foot, especially the toes, was blanched and notably colder to the touch than the right.

A band of paræsthesia (pin-prick felt like the touch of a finger) was noted on the antero-external aspect of the left leg stretching down from the lower border of the patella on to the dorsum of the foot. A slight touch on the sole of the left foot gave rise to a burning sensation.

The tendon-jerks were normal and equal on the two sides and flexor plantar responses were obtained.

A fortnight after admission the right brachial and left femoral arteries were cut down on and explored.

The right brachial artery was difficult to identify, so shrunken had it become; no pulsation was noted in it; there was no evidence of periarteritis.

A limited periarterial sympathectomy was performed on this vessel.

The left femoral artery was explored in Scarpa's triangle; it was noted to be non-pulsatile, solid to the touch, and cord-like in appearance, with marked fibrosing periarteritis; a small portion was removed after ligation, *no* bleeding occurring from the cut ends; the excised portion of the artery contained gelatinous, partly organized, clot.

Histological appearance of section from excised portion of femoral artery: The artery wall shows a uniform concentric thickening with consequent diminution of its lumen. The increase is largely due to increase of the media (i.e., external to the internal elastic lamina), the muscle fibres being almost replaced by fibrous tissue. The intima is not thickened to any extent, but shows some splitting of its elastic lamina. The adventitia shows evidence of considerable periarteritis with increase of the fibrous and elastic tissue elements. The gelatinous clot shows the histology of an organizing thrombus.

For two months subsequent to the operation the patient's condition undoubtedly improved; he slept better and was able to walk short distances without discomfort.

With a view to possible insulin therapy a blood-sugar curve was done and found to be normal; thyroid medication was tried with no obvious benefit.

About two months after the operation he began to complain of pain in the right groin along the course of the femoral artery; the right dorsalis pedis pulse was noted to be present but much more feeble than formerly.

About the same time he also complained of pain along the course of the left radial artery.

A month later he was unable to walk on account of pain in the right leg; the right dorsalis pedis artery, which, three months previously was felt to pulsate strongly, was no longer felt except as a thin non-pulsatile cord.

At the same time the left radial artery was felt to be greatly thickened, especially at its lower end overlying the styloid process of the radius, where a circular band of thickening could be felt. Pressure on this thickened portion of the artery caused him pain "like the pricking of a pin." A hardly perceptible pulse was felt in this thickened portion of the artery although the pulse was much stronger immediately above it.

Some five months after admission, during which time the obliterating process had steadily progressed from limb to limb, he passed out of our observation being invalided to the U.K.

Points of interest in this case were the characteristic history, typical histological changes in the affected arteries, sensory changes, and the rapid spread of the disease during a short period of observation in hospital. No note was made as to his religion, but he had not the appearance of a Jew. Like the other two cases mentioned above, he had led a roving life prior to joining the Army. His cigarette consumption was moderate and there was no history of syphilis.

In view of the anæsthetic patch on his left leg it is possible that the same sclerosing process which produced the arteritis and periarteritis of the limb vessels may have similarly affected the small nutrient vessels of the external popliteal nerve.

The only ætiological factor of importance was the long history of recurrent malaria.

Case 4.—Pte. B., aged 28, was admitted to the British Military Hospital, Rawalpindi, on October 26, 1930, for chronic rheumatism, chiefly affecting the legs. He had been a miner in civil life and had worked in wet mines.

He belonged to a unit which had recently come to Rawalpindi from Razmak, a bleak hill station in Waziristan at an elevation of nearly 7,000 feet. Since the unit arrived in 'Pindi several cases from it have been invalided for severe and intractable rheumatism.

On examination he was noted to be of poor physique with a tendency to cold feet and limbs, and a generally "poor circulation"; his feet were

malformed and ill-suited for marching, there being a tendency to pes cavus with hammer toes, a much more crippling deformity for an infantryman than flat feet.

No pulse was felt in the right dorsalis pedis artery; pulse was just perceptible in the left; both posterior tibial pulses were strong.

The radial artery was noted to be unduly palpable; systolic blood-pressure 120 mm. of Hg.

He made no improvement while under observation in hospital and was finally invalided.

I believe this case to be a "border-line" one. From his history and clinical condition he should be considered, I think, rather a case of chronic rheumatism with poor peripheral circulation than a case of Buerger's disease; time alone will prove.

There was no definite history of intermittent claudication, although he complained of a "tired feeling" in the calves of his legs after walking any distance.

It is in a case of this type that, presumably, valuable aid may be afforded by Pachon's oscillometer, which has proved useful in the hands of Cawadias [21] and others.

Treatment.

The treatment of thrombo-angiitis obliterans is notoriously unsatisfactory and, according to Buerger, a high proportion (fifty-two per cent in his series) progress to amputation.

Insulin therapy is considered by some to be efficacious, but was not tried in any of my small series as the blood-sugar curves were normal in each case.

Protein-shock (intravenous T.A.B., yatren, casein, etc.) has been favourably reported on.

Local measures such as diathermy, radiant heat, ultra-violet rays, Bier's hyperæmic therapy, etc., have, within limits, proved useful in some cases.

Some recommend massage; others consider it directly contra-indicated [6].

Silbert [22] considers it extremely important to stop smoking.

Cawadias [6] treats the arterial spasm with nitrites, aspirin, acetyl-cholin, as well as such local measures as warm foot-baths, radiant heat and diathermy.

The surgical treatment of this painful and crippling disease is not within my province, and a brief note will suffice.

Leriche's operation (periarterial sympathectomy) appears to have fallen into disfavour with most surgeons, and even Leriche [23] himself apparently limits its usefulness, as far as this condition is concerned, to the alleviation of pain.

Recently, a combination of periarterial sympathectomy with lumbar ganglionectomy has been introduced by Adson [24], of the Rochester school, and performed by him on several cases with apparent success.

Left suprarenalectomy has been performed on some cases by Oppel in Russia, but, according to Leriche [23], has not been much employed outside that country.

In spite of all conservative methods, most of the severe cases drift on to amputation sooner or later.

In my opinion, however, there is a considerable number of mild cases which are at present wrongly diagnosed in the early stages, or have been allowed to drift into an advanced condition of obliterative endarteritis. It is possible that much may be done for these early cases by suitable medical measures before the sclerosing process has advanced too far, just as many a case of gastric ulcer may be saved from the surgeon's knife if medical treatment is instituted in the early stages.

The urgent necessity is to discover the cause of this baffling and intractable disease.

Summary and Conclusions.

(1) Thrombo-angiitis obliterans may be described as a localized form of obliterative endarteritis characterized by a special tendency to thrombosis, attacking equally the arteries and veins, especially those of the lower limbs; it occurs typically as a pre-senile disease in men; the ætiology is unknown, but the disease is influenced in some way by tobacco intoxication, but not by syphilis.

(2) The disease is far from rare and is of universal distribution.

(3) It is not uncommon in the British Army, attacking all ranks.

(4) Whilst the cause is unknown, the pathology and symptomatology are remarkably uniform.

(5) The treatment is unsatisfactory; most cases progress to amputation of one or more limbs.

(6) The exact relationship of Buerger's disease to other forms of arteriosclerosis and endarteritis is uncertain.

(7) The pulse in one or other of the small arteries of the foot (dorsalis pedis and posterior tibial) is not appreciable in a high proportion (thirty-two per cent of one series examined) of apparently normal and symptomless individuals.

(8) It is uncertain what proportion, if any, of the above might be considered potential or early cases of Buerger's disease.

(9) No special ætiological factor bearing on the problem was found to exist in the above series of thirty-two cases.

(10) Clinical notes are given of four cases. Of these, three are considered to have been typical examples of the disease; one (Case 3) showed rapid advance of the obliterating process in the arteries during a short stay in hospital. One patient (Case 4) was considered to be a "border-line" case.

In conclusion, my thanks are due to Major D. C. Monro, R.A.M.C., Surgical Specialist, Rawalpindi District, who performed the periarterial

sympathectomy on Private P., and who is responsible for the report on the condition found at operation: also to Major C. H. K. Smith, M.C., R.A.M.C., D.A.D.P., Rawalpindi District, for his report on the microscopic appearances of the section of the femoral artery.

REFERENCES.

[1] Buerger, L. *Amer. Journ. Med. Sci.*, 1908, 136, pp. 567-580.
[2] Buerger, L. "The Circulatory Disturbances of the Extremities, including Gangrene, Vasomotor and Trophic Disorders," W. B. Sanders and Co., 1924.
[3] Wheeler, Sir W. I. De C. "Thrombo-Angiitis Obliterans," *Brit. Med. Journ.*, February 5, 1927, p. 225.
[4] Smith, R. P., and Patterson, D. Wells. "Thrombo-Angiitis Obliterans in Association with Syphilis," *ibid.*, February 5, 1927, pp. 227, 228.
[5] Telford, E. D., and Stopford, J. S. B. "Thrombo-Angiitis Obliterans," *ibid.*, December 6, 1924, pp. 1035-1037.
[6] Cawadias, A. P. "Endarteritis Obliterans of the Extremities," *ibid.*, February 8, 1930, pp. 234-236.
[7] Parkes Weber, Rast, H., Lutteroti, O. "Thrombo-Angiitis Obliterans in Non-Hebrew Subjects and Report of a case of Ulcus Cruris in a Young Man," *ibid.*, August 23, 1930 p. 279.
[8] Priest, R. "Clinical Coincidences," Journal of the Royal Army Medical Corps, November, 1930, p. 327.
[9] Meleney, F. N., and Miller, G. G. *Ann. of Surg.*, May, 1925.
[10] Harris, H. A. "Vascular Diseases and the Sympathetic Nervous System," *Brit. Med. Journ.*, April 30, 1927 (quoted from).
[11] *Idem.*, p. 791.
[12] Adson, A. W. *Minnesota Med.*, 1925, viii, p. 275.
[13] Symposium on "Some Diseases of the Jewish Race," Med. Society of London Jewish Hospital, June 13, 1929 (*Brit. Med. Journ.*, July 13, 1929, p. 51).
[14] Rabinowitz, H. M. "Experiments on the Infectious Origin of Thrombo-Angiitis Obliterans and the Isolation of a Specific Organism from the Blood-stream," *Surg.. Gynæc., and Obst.*, September, 1923, pp. 353-360.
[15] Dixon, W. E. "The Tobacco Habit" (Norman Kerr Lecture delivered before the Society for the Study of Inebriety), *Brit. Med. Journ.*, October, 1927, pp. 719-725.
[16] Geoffrey Evans. "The Nature of Arterio-Sclerosis," Goulstonian Lectures, 1923.
[17] Silbert, S., and Samuels, S. S. *Journ. Amer. Med. Assoc.*, 1928. (Quoted from *Medical Annual*, 1929, p. 483).
[18] Parkes Weber. *Quart. Journ. Med.*, 1915-1916, ix, 289.
[19] Quoted from (3).
[20] *Thèse de Paris*, 1928. (Quoted from *Medical Annual*, 1930, p. 80).
[21] Cawadias, A. P. "The Oscillometric Examination of Arterial Permeability," *Brit. Med. Journ.*, March 5, 1927, pp. 419, 420.
[22] Silbert, S. *Jour. Amer. Med. Assoc.*, 1927, 89, 964.
[23] Leriche, Professor Rene, and Fontaine, Dr. Rene. "Surgery of Blood-vessels," *Medical Annual*, 1930, pp. 77-80.
[24] Adson, A. W., and Brown, G., *Surg., Gynæc., and Obst.*, May, 1929, p. 557.

OUR STATION.

By OLA.

(*Continued from p. 34.*)

Individually, the women of the Royal Caterpillar Corps are fine wives and model mothers. Each one is a domestic success. Collectively, they are independent and self-willed, exigent and not at all amenable to military discipline. As a community they are a menace to officialdom. A band of Scotswomen who take a pride in "sticking out for their rights" can give more trouble to the authorities than a plague of flies, a series of courts-martial or a strike of sweepers.

Not only do the Scots wives worry the M.O., the S.S.O., the Q.M., and the P.-S. but, by their machinations, they induce in these harassed officials a frame of mind which, in the end, leads to the employment of that subterfuge known as "passing the baby." The fact that this subterfuge is self-protective does not make it the less abominable, since it so often results in the undoing of one's nearest and dearest friends.

This season it was Mrs. Magneto, formerly of the Clan Mactavish, who opened the campaign. She complained to the Provost-Serjeant that, during the issue hour, the noise at the ration stand was unbearable; that it was affecting the health of the Magneto family; and that, if something was not done about it, she would complain to the Commandant.

The P.-S. said he could not arrest a noise, and passed the complainant to the Q.M.

It must be admitted that the Q.M. displayed a lamentable lack of tact. He was of opinion that the physical condition of Mrs. Magneto and family would be improved by a course of early rising. After all, no issues were made from the ration stand before 7 a.m.

Any amateur psychologist could have foretold the result of this most inappropriate form of treatment: it merely served to transform Mrs. Magneto from a grumbler to a fury—and a dour one at that. She sought an interview of the S.S.O., and, at the third attempt, succeeded.

Milord promised favourably to consider the complaint, provided the M.O. would certify that the health of the Magneto family was being prejudiced by the offending noise.

By this time a week had elapsed and, in the pursuit of justice, Mrs. Magneto had walked about fifteen miles. Nevertheless, and after a two days' rest, Mrs. Magneto and four little Magnetos appeared at the Families' Hospital.

The M.O. regretted he could do nothing without a Morning Sick Report, and he explained to Mrs. Magneto how to procure this form from

the S.S.O., to have all particulars filled in by the P.-S. and to have it signed by the Q.M.

Mrs. Magneto decided to rise in future at 06·45 hours.

The next shot was fired by Mrs. Gearbox, a daughter of the house of Auchterlonie. Her complaint was that Mrs. Dubbin's Airedale-Labrador "Gertrud"—but no; it would not be seemly here to record the misdeeds of "Gertrud."

As soon as Mrs. Gearbox had completed the usual round and acknowledged (to herself only) defeat, Mrs. Klaxon—whose maiden name was McTocher—delivered a more serious form of attack. Mrs. Klaxon alleged that the Q.M.S. habitually issued the best cut off the joint, the freshest vegetables and the lion's share of the coal to Mrs. Sparelace; and that, if Drummer Sparelace were not sent for at once, she herself would write to the drummer's C.O. and expose the scandal in all its nakedness and enormity.

This formidable threat to the peace of the station could not be ignored, especially as Mrs. Klaxon was well known to be an uncompromising Covenanter. Accordingly there was assembled an informal court of inquiry composed of the S.S.O. as president, and the M.O. and Q.M. as members. The court was of opinion that the matter should be investigated and reported on by the padre.

Enough. The Scots' war of attrition—like most wars of the same kind—is entertaining, and even exciting, at first. Later on it becomes wearisome and boring and, in the end, merely exasperating. When that stage is reached, the war is carried into the enemy's country and the disturbers of the peace are laid low—temporarily. It is certain that, under a new staff, or in a new station, the militant Scotswomen will revert to their ancient and popular pastime of keeping the authorities up to the mark and free of mould.

The C. of E. padre in the East End is a great contrast to the R.C. priest in the West End. The good Father Francis Mary comes from Yorkshire: he is tall, slim and jovial. The indomitable Reverend James Cloister hails from the Isle of Man and is short, squat and saturnine. He is young, inexperienced and High Church, and has not yet learned that to err is human; at least, he has not yet appreciated the practical aspects of that great truth. The rude soldiery call him "Jerks" because, during a service, he bobs, bows and does sentry-go with the energy and endurance of a P.T. expert. The ladies have christened him "Selfridge," on account of the number and diversity of his oft-changed vestments. He is the only man in Our Station who owns two nicknames, and he has never heard either. The Reverend James Cloister finds life so tense, so earnest, so much in need of reformation that, up to date, no one has had the courage to address him by anything more flippant than "padre." Of course Jerks

is a grand worker, and for that we respect him; but we do wish he would smile or make a joke—even a feeble one—occasionally.

On the hillside, facing north, the East End bazaar spreads its tentacles in every direction in which the builder's art is able to fasten a structure to the steep slope. Here, in untidy, straggling lines are to be found the hangers-on: the illicit dairy posing as a vegetable shop; the pork butcher's disguised as a picture-postcard stall; the native liquor shop, where the sahibs' cigarettes are staked against the memsahibs' chocolates in the fascinating game of get-rich-quick. In India petty gambling dazzles, and often ruins, the menial classes. One of the Ogpu Sahib's favourite sayings is, "Show me a dishonest servant and I will show you a gambler."

The body of the bazaar consists of a square, solid building, the property of the cantonment authority. It is divided into big stalls and shops which are rented by the more reputable and wealthy traders. The leading establishment belongs to Messrs. Bhag-Mal, Jag-Mal and Sons, Ltd. Here you may purchase anything from a Japanese tin-tack to a German refrigerator, anything from "Around the corner," to Tosti's "Good-bye," anything from a 1929 Christmas card to a 1928 Christmas annual. Wiltshire hams, gaudy handkerchiefs, babies' rattles, baskets, barley-sugar and bottles of beer, brandy and Bovril are mixed in wild confusion on shelves, on the floor and in dark, dusty corners where the scorpions have their homes. It is intriguing to wonder how, and from whence, this amazing collection of junk has been garnered; but on this point Messrs. Bhag-Mal, Jag-Mal and Sons, Ltd., are as silent as Garibaldi. Garibaldi, sadly disfigured by the repeated attacks of fish insects, stares out from the surface of a lithograph (*circa* 1887) which occupies a place of honour facing the doorway of the shop. Messrs. Bhag-Mal, Jag-Mal seem to think that the legend "Garibaldi" represents the name of the artist, or the frame maker, or the original owner of the picture, because Mr. B.-M. is of opinion that, "It ees curio: it ees portrait of Kilive Lat Sahib," while Mr. J.-M. says: "Noa: it ees very rare representation of Nikalsain Sahib. Collector's piece." "But"—you protest—"what about this 'Garibaldi'?" "Oh, sahib! we are educated men, matric. Punjab University: we are extentively aware history of India: we have failed finding name of 'Garibaldi' therein."

Of one thing at any rate there is no doubt; the lithograph is an asset; it impels attention; and after you have studied this wonderful work of art and been stricken with astonishment and dismay, you are unlikely to leave the premises without buying something which you neither need nor desire. Although Garibaldi is a sleeping partner, he has put a large sum of money into the coffers of Messrs. Bhag-Mal, Jag-Mal and Sons, Ltd., and these wily gentlemen know it. One day, by way of a joke, I tried to purchase Garibaldi. His intrinsic value, frame complete, is about one rupee. At Rs. 12 I gave up the contest.

An attractive shop is that of Bostan, the fruit and vegetable seller. Here you may buy rosy-cheeked apples of the texture of wood, the consistency of turnips and the taste of glucose; or smooth, golden pears, flavoured with brilliantine; or up-country mangoes reeking of turpentine; or diminutive grapes packed in adherent sawdust; or marrow which is all congealed green water; or super-mushy, brinjal; or lady-finger, the mother of "Gloy." In fact, here you have the best concrete examples of the old saying that beauty is but skin deep.

In India, the greatest joy to the eye and the greatest disappointment to the palate, is to be found in the fruit and vegetable stall.

Old Bostan has heard of the products of Kulu and Kashmir; but why stock such expensive luxuries when the indigenous varieties may be sold at a profit of 200 per cent? Besides, did not his father before him say: "Better incur the memsahib's wrath and grow rich than bask in her favour and remain poor." And when you come to think of it, there is some sense in that remark.

We take the path up the hill, passing the shops and stalls which cater for the Indians—the pan and betel vendor, the sandal maker, the sweetmeat man with his cohorts of flies and fumes of boiling ghi—and arrive at the garrison school.

The school buildings are divided into three parts, for the men, the children and the infants. The two portions devoted to the rising generation are of great interest, firstly, because here is proof that children can be positively angelic, provided they are removed from their parents; and secondly, because here we may meet and converse with the authors of this remarkable phenomenon—the Army schoolmasters and schoolmistresses.

The pedagogues of the Army form a little-known, superior and wholly admirable class. They deserve more support and encouragement than, as a rule, they receive.

Look at the cherubim and seraphim adorning Italian church and house architecture. Where on earth did the models come from? From the Army schools, of course. Michael Angelo must have been an Army dominie, and his models the children of soldiers, sculptured during school hours.

From the school windows you have a magnificent awe-inspiring view. A great valley yawns below and huge, tree-clad mountains rise, tier on tier beyond. In the far distance the snows wed the clouds in a riot of white, silver and grey.

Behind the school the main road follows the sinuous line of the ridge. Tall pines provide shade against the mid-day sun and cover the ground with a carpet of russet-coloured needles.

We round a corner and come suddenly on a group consisting of an enraged British officer, a dozen scared "tat-walas" and a dozen sorry-looking "tats." The officer is fluent, and his use of vernacular epithets

betrays a knowledge of Urdu which is most extensive and deep. He impresses on the pony-men that they are bastards, the sons of monkeys and the brothers of goats; that, in a future existence, they are destined to inhabit the bodies of diseased donkeys and badmash mules; and that, for the present, Gul Akhbar and Alizai Khan will be lodged with the Ogpu Sahib, while their miserable ponies will be sent to the veterinary hospital in Likhnabad.

This is severe punishment. It means a fine and (or) imprisonment, and also a stiff payment to the hospital before the ponies can be reclaimed.

Messrs. Gul Akhbar and Alizai Khan depart, weeping and wailing. The remaining tat-walas disperse, inwardly vowing to feed their animals and to tend their sores—for the next few days at any rate. There is no gnashing of teeth because, when Caesar Sahib is angry, it is unsafe to gnash the teeth.

You should note this little incident because, in India, it is not a common one, alas! Now and again one meets an animal-lover who has the courage and energy to put his principles into practice; but he is like a voice crying in the wilderness. As a rule the Englishman soon realizes the complete absence of public opinion on this subject. Everywhere he is faced with gross ignorance and callous indifference. He gives it up as a bad job.

From the wretched animals' point of view, who is most blameworthy—the hard-hearted Mussulman, the super-hypocritical Brahmin or the enlightened Englishman?

Major Caesar Cogwheel, of the Royal Caterpillar Corps, and O.C. East End, is an enigma. It would be safe to surmise that he would champion the cause of the suffering animals, but it would be impossible to guess at what prompts his conduct: natural kindliness, innate eccentricity or religious conviction.

Caesar is of medium height, spare and as hard as nails. His face is creased and the skin is tanned the colour of old parchment. His hair is thick, coarse, unruly and nearly white, and his eyes are a light grey. He has served successively in British infantry, Indian cavalry, R.A.F. and R.T.C. From tanks he drifted into caterpillars, and now he is hoping to obtain command of a militia corps composed of frontier scallywags. His changes of religion have been as curious, if not so numerous. Starting life as a Plymouth Brother, he passed from that to Greek Orthodoxy and from that to agnosticism. At present he is a convinced Buddhist. He talks and thinks in seven different languages, and is alleged to be a woman-hater.

Of course it is this last trait which, above all others, appeals to the ladies of Our Station. They can read Caesar's thoughts: they know all about the inner workings of his mysterious mind and they have decided that, once upon a time, Caesar was disappointed in love. The result is that frantic and persistent efforts are made to guide Caesar into the path of matrimony.

So far, these efforts have come to nothing—except, perhaps, to supply Caesar with fresh material on which to meditate. He is always meditating and, when you are favoured with the fruits thereof, you discover a half-cynical, half-humorous mixture which is hard to analyse: you are not sure whether Caesar should be consigned to a Himalayan monastery or exported to Montmartre.

With an upward sweep the Mall ends in a small, lozenge-shaped plateau which dominates the immediate neighbourhood. This plateau is on a level with the roofs of a number of buildings—barracks, stores and institutes—by which it is encircled.

Ordinarily it is a forbidding spot, bleak and cold or dusty and hot—deserted save by an occasional visitor who has come for the sake of the view. But picture the plateau on a certain windy afternoon in the beginning of May.

It seethes and hums with crowded, vociferous humanity.

All the world and his wife are there.

In Our Station such chattering and shouting, such herding and marshalling, have not rent the air or shaken the earth since the summer of 1857. Not since the Mutiny has there been such a *burra tamasha*, such a *mushkil bandobast*.

What is afoot?

The grim spectre of war.

A few days prior to this great gathering grave disturbances had occurred in Peshawar. The city was seriously menaced from the south. The northern horizon was stormy. The temper of the western marches was uncertain. To the east alone was there reasonable security, and even that might not endure.

Likhnabad held the key to the eastern approaches and, at this juncture, Likhnabad did a thing which always lands everybody in trouble.

Likhnabad made an appreciation of the situation.

This appreciation opened with the disturbing information that the range of hills between Likhnabad and Peshawar was the home country of the Shaitan Khel and the Zulmzai. These tribes had been guilty of various misdemeanours in the past—notably in 1869, when an expedition under General Alexander Flintlock, K.T., had occupied their territory for a period of six months. This was an expedition on the grand scale, for the field force consisted of 5,000 officers and men, 15,000 followers and 30,000 transport animals. In the end it was wiped out by cholera; but it created a lasting impression, because the same disease spread and wiped out most of the enemy too.

The appreciation went on to say that, since 1869, the survivors of the Shaitan Khel and Zulmzai have been living in peace and affluence by supplying Likhnabad and out-lying cantonments with fowls, eggs, cooking butter, milk of doubtful purity, vegetables and "tats" on hire.

"Nevertheless" (to quote the appreciation) "the situation is fraught with unpleasant possibilities."

"Fortunately our farthest outpost against these potential enemies is strategically well sited and tactically strong; it contains a sufficiency of material and stores of all kinds, and the medical arrangements are satisfactory. The garrison is prepared to hold out to the last round and the last man."[1]

Modesty forbids me to name this outpost.

Pride convinces me that to name it is unnecessary.

When the news leaked out that Our Station was to have the honour of taking the first knock, up went our tails, and we all felt sorry for the Shaitan Khel and the Zulmzai.

Followed the torturing agony of suspense—as "the pictures" would say.

Eager as we all were, it was impossible to rush matters. For instance, we could not precipitate a collision; we had to sit tight until attacked, and so were denied the use of that most powerful of all weapons—surprise. Then again, the necessity for secrecy acted as a brake. It always does. If you must enclose a letter in two much-travelled envelopes instead of in one, if you must fasten one of the envelopes with sealing wax, if you must stamp the wax with a seal which lives in a locked box, and if you must fasten the second envelope with a so-called economy label—why, it all takes time.

F.S.R. ignore these little points.

And there are others, thus—the official sealing-wax becomes gummy, it won't melt. The seal has to be found, it lies in a dark corner, under a pile of obsolete Army forms, travelling warrants, string, pencils, rubber, ink powder and red tape. When it is found, the impression is ruined by long stalactites and festoons which connect it with the envelope, like the wireless arrangement on a t.b.d.

Secrecy has its drawbacks, not the least of which is a waste of time and temper.

Lastly, Mary had to make an appreciation of his own situation; and this appreciation had to be submitted to Likhnabad for approval before the plan contained therein could be put into force.

Mary mobilized the best brains in the station—Caesar's, Pom's, Milord's and the M.O.'s—and they were very good. We turned out an appreciation which, we flattered ourselves, was unique in its simplicity, sound in conception, trenchant in wording and singularly offensive in spirit. Perhaps it was not quite orthodox as, for example, the manner in which it treated of "Courses open to the enemy," thus:—

[1] *From this the discerning reader will realize that the author of the appreciation was not a subscriber to the "Journal of the Royal Army Medical Corps."*

"There are several courses open to the enemy. These will not be discussed here because, whatever may happen, the 'Plan' detailed below will meet any and every contingency."

Alternative plans of action open to us were disposed of in the same sure and summary fashion.

"There are no alternatives to the 'Plan' detailed below."

The appreciation went forward sealed by Mary, enveloped by Milord and registered by Mr. Brikhbhan Chatterjee.

In vain we awaited the verdict. Neither comment nor criticism, neither approval nor disapproval marked the receipt of the document.

It was not even acknowledged.

Kilo considered that, for the moment, "G," Likhnabad, felt himself unable to write in the courteous style incumbent on military scribes who move in the best circles.

Jerks suggested that, in all probability, "G" had been admitted to hospital suffering from apoplexy.

Father Francis Mary was kinder. He was of opinion that the appreciation had fallen into the hands of the enemy while *en route* to Likhnabad, and that this fortunate accident had brought the war to a premature close. He even went so far as to predict a brevet for Mary.

Serene and confident, the brains of Our Station paid no attention to these silly surmises. The brains of Our Station *knew*: they knew that their appreciation was unanswerable; that, in its perfection, it contained its own answer. We of the brains were content and proud to leave it at that.

Surely this is the first time on record that a Headquarters office of the Army in India has signified consent by keeping silent.

So it came about that, on his own initiative, Mary issued operation orders for a rehearsal by all hands. These orders were headed: "Emergency Concentration and Defence Practice"; and I think it is worth while saying something about the business for, so far as I am aware, no account—official or otherwise—of the proceedings is extant. There are lessons to be learned from this practice and, in addition, there are certain things which ought to be recorded; the resource and cheerfulness of the officers, the indefatigability of the N.C.O.'s, the cynical stoicism of the men, the patience and fortitude of the women burdened by many children and exposed to the rigors of a windy day in May, the inscrutable impassiveness of the native followers, the classic failure of Q.M.S. Partworn. . . .

From the outset the Q.M.S. threw himself heart and soul into the project. Unfortunately his burning enthusiasm was not well balanced, and this led to his undoing; it was decided that, unless the Q.M.S.'s activities were diverted into a safe channel, they might over-run the limits of usefulness and safety. Hence it was decreed that the Q.M.S. should be responsible for the production of an active and, if possible, bloodthirsty, enemy.

That kept him quiet and busy.

He tried the barrack boot boys. They flatly refused to have anything to do with a fight, sham or otherwise. He tried the pony men, the M.E.S. road coolies, the hawkers and—as a last resource—the cantonment sweepers. All declined, promptly and firmly, and on one pretext or another, to participate.

On the evening before the practice a large and excited crowd of men and women gathered on the hillside below the followers' lines. The head chowkidar presided. He was wearing his grandfather's Mutiny Medal. In a loud voice he declared that he would rather die of the plague than lower his *izzat* by fighting—or even by pretending to fight—the descendants of Nikalsain Sahib.

This pronouncement was received with shouts of "Wa-wa! Ram-ram! Nikalsain ki jai!" from the assembled multitude, and the Mutiny Medal was passed round, and kissed by everyone present—excepting the sweepers, who were graciously permitted to salaam to it.

This was told to me by the Ogpu Sahib, whose comment was: "Doubtless Our Station is the most honourably moral cantonment from Lahore to D.I.K."

In reporting his failure, Q.M.S. Partworn said: "If I wants anythink, I indents; but 'E.——Enemy' ain't to be found in any Army book I knows of—not even in the 'Priced Vocabulary of Stores.'"

"Very disappointing," replied Mary, "but it can't be helped. You're detailed to check the baggage."

Poor Partworn retired, crestfallen.

Each of us was allowed: (*a*) "One small article of luggage which must not weigh more than half a maund"; and (*b*) a roll of bedding. Followed by our servants, we made for the rendezvous. At the entrance to the defended area stood S.M. Roster and Q.M.S. Partworn.

The S.M., armed with a nominal roll (in triplicate), credited each arrival with a "p." Between each "p" he licked the business end of his stubby pencil; our S.M. is no office wala.

Some nasty asides were made when it was seen that there was only one absentee; Mrs. Roster. Milord, hearing of this, treated the S.M. to a sharp rebuke; but this action was hardly justifiable because—as everyone knows—a garrison serjeant-major's wife is a law unto herself.

Little Marjorie Sparelace, aged $\frac{4}{12}$ years, was nearly overlooked. The mistake was rectified in the nick of time by Marjorie herself, who emitted an ear-splitting "Guroo-iya-iya-guggle-iyell!"—thereby drawing the S.M.'s and everybody else's attention to her presence.

Q.M.S. Partworn had an easy and uninteresting task—until Mrs. Cartridge arrived. The lock of Mrs. Cartridge's tin trunk was in need of repair, and it gave way at an inopportune moment, causing the contents of the trunk—two chunks of wood and a lump of coal—to land heavily on

the Q.M.S.'s toes. Mrs. Cartridge explained that she had not been given sufficient time in which to pack a change of clothing, a tooth-brush, soap and towel; but unfortunately her explanation was not quick enough. Partworn got in first, and what he said nearly started a riot. It was only the timely intervention of Father Francis Mary which saved the situation.

The various individuals and parties were then taken over by the Provost-Serjeant, who directed them to their allotted places. It was the job of the P.S.'s assistants to maintain order and prevent wandering, and undoubtedly this was the hardest and most unpopular task of all. It is safe to say that, had it not been for the tact, energy and watchfulness displayed by the good Father and the Honble. Charlotte, the defended area would soon have become pandemonium.

The Honble. Charlotte was handicapped by the fact that little Marjorie Sparelace declined to abandon her slogan— "Guroo-iya-iya-guggle-iyell!" —even for a second, except when ensconced in the Honble. Charlotte's arms.

Father Francis Mary again distinguished himself by saving Private Magneto from assault and battery. Mrs. Spavin was the aggressor. Magneto, in his capacity of R.M.P., had merely retrieved Mrs. Spavin's Albert from the orderly room waste-paper basket. For this act of kindness the outraged mother was preparing to slap the policeman's face. "I'll teach 'im to lay 'is 'ands on me little Albert," said she.

"Take your little Albert away at once, or I shall give him what he richly deserves: a sound thrashing" broke in the Reverend Father with unwonted acerbity.

Private Magneto whistled, removed his topi and wiped his brow.

The arrival of Mr. Bhuj-Bal Singh and staff from the dairy caused a momentary hitch. Mary had counted on their attendance, but he had not reckoned on the entourage—to wit, the dairy herd complete. That is the worst of the Indian; either exasperatingly sketchy and unpractical, or brutally literal and realistic.

A lively Rodeo ensued. It featured cows, buffaloes, two bulls, numerous children, countless dogs and a sprinkling of perspiring policemen, B. and I. Eventually a stance for the bovines was found and comparative peace and order reigned once more.

Meanwhile, Mrs. Breach and Mr. Pereira busied themselves with arrangements for an improvised hospital; Mr. Le Quesnoy made plans for the theatre and labour room attached thereto. We all felt glad that there were no exacting specialists nearer than Likhnabad.

The M.O. did a full day's work. He soon realized that R.A.M. College standards of hygiene would have to be jettisoned; and that, in this case, the basic principles of sanitation in force in the ordinary Indian village would have to be adopted. He was hard put to it to remember what these basic principles were. His difficulties were much increased by a terrific

dog fight—the Saugor Alsatian-Airedale *versus* the Dubbin Airedale-Labrador—in the course of which Mrs. Dock was bitten and had to receive first-aid.

At this point a diversion occurred which, under less able management, might have had disastrous results. A convoy was sighted in the distance. It consisted of pack ponies, donkeys and bullocks. With the aid of field-glasses we could see that it was being led by Barumpta Khan, head of the Shaitan Khel, and driven by Mahomed Taklif, chief of the Zulmzai.

This, of course, was the weekly convoy of fowls, eggs, cooking butter, milk of doubtful purity and vegetables. Barumpta Khan and Mahomed Taklif, finding the bazars empty, had decided to push on to the scene of action and find out what all the fuss was about.

Our Aryan brother's curiosity is insatiable.

A pretty state of affairs!

There was a moment's confusion and embarrassment; but Mary, on being apprised, took in the situation at a glance, and despatched Caesar and the C.E.O. to deal with it. Both officers rose to the occasion, and the danger was warded off within two hundred yards of our perimeter.

Afterwards we heard that Caesar had spun a yarn about an open-air revivalist meeting which, being a religious matter, could neither be interrupted nor broken off. The C.E.O. had added (in the local *patois*) that the sahibs were engaged in one of their insane ceremonies which neither he, nor anybody else, could understand; but that, in any case, none but invited guests might attend.

Barumpta Khan said: "Your Honour's slave would have made a point of being present—had he been invited. A durbar is a great event"; and Barumpta emitted a hearty eructation in token of his profound disappointment.

Mahomed Taklif was more considerate and polite. "Oh, Protector of the Poor, we are all seekers after the one God, and therefore do we leave you to carry out your devotions in peace—albeit your prophet is a false prophet. Nevertheless, he was a good man. *A-salaam-aleikum!*"

The precious pair departed, more or less satisfied and suspecting naught.

Mrs. Spurs and Mrs. Surcingle were the last to arrive. The former limped down from the West End with a blistered heel; the latter appeared in her very best frock—the frock that takes half an hour "to do up."

By this time the Honble. Charlotte had started a crêche, where Marjorie Sparelace was joined by Jasmine Klaxon and Wilfred Gearbox. This trio beat all-comers but, so long as one kept out of ear-shot, there was no need to worry, since the Honble. Charlotte seemed to be perfectly happy and unperturbed.

Still, for the sake of one's nerves, a visit to a less disturbing area was advisable: to the perimeter, for example.

The wooded slopes on the west and north were allotted to Pom. Kilo urged that a broad belt of trees and undergrowth should be cut down, so as to provide a clear field of fire. Pom demurred, pointing out that, as this would take about a year to accomplish, it was better to leave things as they were; so the men were set to wiring and digging pits, while P. and K. invented booby traps of an ingenious and fiendish description; and the more ingeniously fiendish these traps were, the higher did their inventors' spirits rise.

The bare hillsides on the east and south were handed over to Caesar who constructed a series of sangared strong-points, with thick, broad belts of wire in the intervals.

There was no lack of stones, boulders, stakes, thorn bush, tough creepers, and similar material of use in strengthening a defensive position; but it is euphemistic to talk of wire and wiring. Every inch of barbed wire in Northern India had been sent to Peshawar and, as that place was calling for more and more, Pom and Caesar were hardly justified in carrying make-believe so far. This, at any rate, was Mary's opinion, and led to the usual futile unending argument—the one about bricks without straw.

(*To be continued.*)

SOME NOTES ON EQUIPMENT.

By Major J. H. M. FROBISHER, O.B.E.,
Royal Army Medical Corps.

Considerable experience in casualty clearing station work during the last war, and after the war in Turkey, taught many of us who were chiefly concerned in surgical work the saving that might have been gained in transport by more careful packing of surgical equipment and also by the abolition of certain equipment which at all times seemed over-generous and even luxurious under war conditions.

As military surgeons in war we must be ready and able to work under conditions to which our civilian brothers would take exception. In peace we expect and insist on the highest standard of equipment in our military hospitals, but under conditions of active service, where mobility and accessibility are of the greatest importance, anything in the way of excessive equipment or indifferent packing is a great handicap.

Peace-time preferences must not be confused with war-time exigencies.

In order to illustrate what is in my mind, only certain examples of suggested improvements will be given. Many others will occur to those interested in this subject.

(1) We possess field service panniers very complete and cleverly designed years ago. Granted that they are not sufficiently complete for modern operative needs, e.g., they have no intestinal clamps in the capital case; they do, however, contain much valuable equipment well packed and extremely accessible.

To these panniers have been added additional equipment, in many cases only duplicating what they already contain.

This additional equipment is "unboxed," i.e., is packed in cases not specifically designed to hold it. The cases on the outside give no indication of their contents, and the packing notes are invariably placed inside the case and often inside the sealed-up tin lining. The cases are nailed or screwed down and, after one or two moves, are little better than matchwood, thus adding to the difficulty of repacking.

Suggestion: bring the field service panniers up to modern standards, by the addition of extra instruments, etc., in leather rolls. The mahogany capital case might, for instance, be removed and all the instruments packed in leather rolls. The case is heavy and alterations to its contents cannot be made owing to the partitioning.

Any additional equipment required beyond that in the field service pannier should be packed in well-made cases, hinged and screwed. The screws should screw into threaded metal sockets to avoid destruction of the case by constant unpacking and repacking.

The outside of the case should be marked by a number and the case should be small enough to be easily carried, and should be fitted with rope handles. It is better to have many small cases than a few cumbersome ones that tax the unit to move.

A booklet should be printed showing what each numbered case contains. I feel that I am treading on some corns when I suggest that a broad-gauge railway will not always be available, and that six-wheeled trackless lorries have been known to break down. I would emphasize that two field service panniers can be carried on a mule, as they are of the correct size and weight and are fitted with "D's" for the purpose.

One more point. In my experience the field service panniers were seldom used to their full capacity, on account of the over-generous additional equipment, and were locked away in the Quartermaster's stores after withdrawal of certain articles.

(2) *Glass-topped Tables.*—These are considered unnecessary in a mobile unit. A wooden case with a sheet of mackintosh is just as effective. If it is felt that tables are a help, a collapsible table with a sheet of aluminium as a top and rather like an artist's stool might be supplied. Half a dozen could be carried in a canvas case. These would be light and unbreakable.

The glass-topped tables are heavy and fragile, and after one or two moves the frames are so bent that the glass will not fit. If the glass is broken, a frequent occurrence, the bottom of a packing case has often to be used, bringing us back to the suggestion that a packing case is all that is required. It is realized that stainless steel table-tops are to be tried in future, but these will be expensive, and the table frames will still be required. Incidentally, it should be remembered that the operating table case is a table when opened up.

(3) *Sterilizing Drums.*—A number of these of varying sizes is a part of the casualty clearing station equipment ; they are unnecessary. They are too fragile, easily bent, and then become a positive danger. They are limited in number, and so continuous sterilization cannot be undertaken owing to the sterilizing orderly having to wait for returned empties and drums to be refilled before he can again sterilize. Their place can be taken by squares of "jean" lined with flannel and fitted with tying tapes. These are in sole use in many peace-time hospitals and are perfectly safe. They cost little, and can be supplied in almost unlimited quantity. They can be packed in canvas cases.

Other examples of over-generosity in equipment exist, and, as a result, much unnecessary weight has to be carried.

(4) *Bad Packing of Equipment.*—What has already been said regarding the cases holding equipment, their manner of fastening, numbering, etc., may be emphasized.

Two further examples will be given :—

Copper Water Drums.—These are supplied for water sterilization in the theatre. They are essential, and must usually be heated by a primus stove.

They come packed in a crate holding two, frequently with a nail driven through one of them. The primuses are packed somewhere else. As the drums are of the same diameter and have their taps brazed in, they cannot be "nested."

Could not the drums be of different diameter, say one inch difference, and the taps arranged to screw in on a copper asbestos washer? The smaller drum could then be packed inside the other, with the two taps, a collapsible tripod and a primus stove. The water sterilization outfit would then be complete in one case.

High-Pressure Sterilizer.—This is packed in a wooden case, and is almost too heavy for the unit to move. It stands on three legs and is fitted with a gas ring.

Could not this apparatus preferably be packed in a barrel, which would enable it to be rolled, or could it not be fitted to a wheeled stand (like the garden water-barrel) to allow of its being towed behind a lorry?

The base of the sterilizer might with advantage be closed in with sheet-iron, thus forming a compartment to hold two or three big four-burner primus stoves. The sterilizer could then also be used in the open; this is important in a tented hospital, as it helps to avoid fire risks.

The gas ring might be dispensed with, as gas is rarely available on service.

A survey of the surgical equipment of casualty clearing stations would certainly show many items in which improvement could be made, leading to a saving of space and to greater mobility.

(5) As a last but not the least important suggestion, I think that still more could be done to ease surgical work in mobile and semimobile units by the provision of what might be termed "an operating table unit."

This term was suggested by Captain and Quartermaster Brennan, R.A.M.C. As far as circumstances permitted, this "unit" was packed as an experiment. All the weights and measurements were worked out, but unfortunately they were given to an Inspecting Officer for perusal and were not returned. Equally unfortunately, no copy was kept.

The idea of the "unit" was to provide a pannier, on the lines of a general service pannier, which would contain everything necessary to perform an operation in the field.

The following brief description will show what I mean:—

Container.—A basket or hamper, fitted with four rope handles for easy carriage, divided into compartments by basket or three-ply wood partitions.

The bottom compartment contains the operating table in its case, the latter forming a table when opened up. Behind this all necessary instruments are packed in leather rolls.

The middle compartment is divided into three by two partitions: (1) Contains bowls, dishes, measures, and all enamel ware; (2) two nested copper water drums, with taps, tripods, primus, as described above; Schimmelbusch sterilizer with its drums and instrument sterilizer;

(3) contains the acetylene lamp, generator, carbide, tubing, and a collapsible shade.

The top compartment contains all theatre gowns, gloves, ligatures, anæsthetic materials, etc.

Such a "unit" is complete. It can be easily carried, and with it any emergency operation can be performed.

A casualty clearing station can be supplied with as many "units" as are thought necessary. Also a field ambulance might be supplied with, say, one to each company and two or more to headquarters.

Any isolated post on the lines of communication, etc., can be supplied with a "unit," and then be in the position to operate if required.

It will be noted that no high-pressure sterilizer is suggested as a part of this "unit." This is intentional. Such a sterilizer would be carried in addition if circumstances permitted, but it is claimed that it is not an *essential.* "Steamed" dressings, or dressings, etc., soaked in weak antiseptic, are adequate for the emergency.

Critics will at once say that I am guilty of suggesting a new luxury, but with the exception of the new hampers, nearly all the necessary equipment can be found from existing stores.

This rather sketchy article will have served its purpose if it gives rise to interest in an important subject, and if it leads to a reduction in the enormous bulk that many of us have had to transport in the past, and may again have to move with.

In spite of the ingenuity of modern mechanical transport, one cannot help feeling that times will occur when even trackless lorries will not be able to move the present casualty clearing station with its wonderful equipment over uncivilized or semi-civilized country.

Editorial.

DIET AND THE TEETH.

In the May number of the Journal, 1930, we drew attention to Mrs. Mellanby's researches on Diet and the Teeth. In Part I of the Report to the Medical Research Council she gave the details of her experiments which proved conclusively that the proper calcification of the teeth in dogs was mainly dependent on the presence of vitamin D in the food, and that certain cereals, notably oatmeal, had an anti-calcifying effect. A reference was also made to the fact that an adequate supply of fat-soluble vitamins is necessary for perfect formation of the periodontal tissues, but no details were given and the respective effects of vitamins A and D were not differentiated.

Part II of Mrs. Mellanby's Report has now been published by the Medical Research Council. The first section is devoted to normal and abnormal periodontal conditions in experimental animals. The term "periodontal disease" is used in its widest interpretation, that is to say, "any morbid condition affecting the tissues surrounding the teeth, ranging from simple gingivitis to pyorrhœa alveolaris with extensive absorption of bone."

Mrs. Mellanby points out that there are wide differences of opinion as to what constitutes perfect and imperfect structure of periodontal tissues, and also as to whether disease commences in the epithelium or in the alveolar bone, and whether external conditions such as dirt, tartar and injury are more important than internal or constitutional factors.

Periodontal disease occurs in many animals as well as man, especially in animals living in captivity or under domestication. Dogs are very susceptible to periodontal disease, and as their diet and metabolism are similar to that of man it may be hoped that any beneficial results obtained from experiments on them will be applicable to the prevention and treatment of the disease in man.

The first essential in the study of the ætiology of any disease is to have a knowledge of the perfect or normal structure of the tissues supporting the teeth and then to investigate the factors which may influence these tissues. In the Report there is an excellent diagram of the cervical regions of a tooth and the related periodontal tissues. The epithelium of the gum and that of the enamel appear to blend in the erupting tooth of a puppy, but later a sulcus or trough appears round the cusp of the tooth which is bordered on one side by the subgingival epithelium and on the other by the epithelial tissues in contact with the enamel at the neck. The sulcus is lined by flattened keratinizing epithelium, which is continuous

with Nasmyth's membrane covering the rest of the enamel. The gum corium, which includes the subgingival connective tissue of the gum down to the level of the bone, consists of dense, white, fibrous bundles, with a complete absence of leucocytes. The alveolar bone is mainly compact.

The periodontal membrane lies between the alveolar bone and the cement. The inner layer of the bone is the lamina dura.

According to Warwick James there is no sulcus in man.

The first experiments were made on the effects of vitamins A and D on the periodontal tissues. In a puppy whose diet contained a fair amount of these vitamins, the structure of the tissues was as follows: the whole gingival region of the jaw was comparatively thin; the alveolar bone was dense; the lamina dura was well calcified; subgingival epithelium was thin with no finger-like processes passing into the corium; there was no cell infiltration of the corium, and the periodontal membrane was thin and regular.

When the diets were deficient in vitamins A and D the following defects were seen: thickening of the gingival margin; imperfect development of areolar bone; poor calcification of the lamina dura; hypertrophy of the subgingival epithelium, with finger-like processes into the corium; cell infiltration of the connective tissue of the corium; irregular thickness of the periodontal membrane.

A very interesting experiment was made with cabbage added to a basal diet containing much oatmeal, separated milk, lean meat, olive oil, orange juice and yeast. Cabbage is known to contain much vitamin A, but comparatively little vitamin D. The control animal, fed on the basal diet without the cabbage, showed poor calcification in the alveolar bone, cement, enamel and dentine; the epithelium was much hypertrophied with long finger-like processes in places; the corium was thickened with much reaction of connective tissue cells. The animal fed on the basal diet plus cabbage had poor calcification, like the control animal, but there was little hypertrophy of the epithelium and no down-growth processes, and the connective tissue in the corium showed very little reaction. This experiment suggested that vitamin A might be primarily responsible for the normal development of the soft tissues, while vitamin D regulates the calcification processes.

Further experiments were then made to test the individual effects of the two vitamins. The source of vitamin D was irradiated ergosterol; and the source of vitamin A was mammalian liver oil. The animals were given a basal diet consisting of bread, separated milk powder, peanut oil, lean beef, orange juice, dried yeast and salt. The experiment lasted four months and during this time the puppies grew well. The animal which received the vitamin A had good development of the soft tissues, the epithelium was thin with no processes, and the corium showed no connective tissue reaction. The hard tissues were, however, poorly calcified. The animal which had the vitamin D showed good calcification, but the epithelium was thick and irregular and there was some connective tissue reaction.

These experiments, being of short duration, illustrated the effects of dietary changes in the developing tissues before there was time for disease as ordinarily understood to develop.

The experiments in Part I, mentioned in our former Editorial, showed that the amount and kind of cereal, especially when there was a deficiency of vitamin D, influenced the calcification of the tissues. Experiments now in progress seem to indicate that with oatmeal in the diet, more vitamin A is required to keep the developing soft tissues normal in structure than when white flour is given as part of the cereal diet.

It is thought that the amount of vitamin A in the mother's diet may play a part in the development of the soft tissues of the offspring, just as vitamin D affects the calcification, but no definite evidence on this point is yet available.

Domestic dogs are known to be very susceptible to periodontal disease, but it has been shown that dogs can be kept for long periods under strict experimental conditions without showing any signs of periodontal disease. For instance, one dog was kept in the laboratory for eight years on soft pultaceous food and without exercise and yet the periodontal tissues were free from disease at the time of death. Therefore the resistance to disease of the periodontal tissues can be safely attributed to changes in the dietary, and experiments are not prejudiced by the laboratory conditions under which the dogs are kept.

The effect of diets containing varying amounts of vitamins A and D on the resistance of the periodontal tissues to disease was next studied. Two animals of the same family were given the same basal diet, which included white flour as the cereal, for a period of six and a half years from weaning. One received ten cubic centimetres cod-liver oil (A and D vitamins) daily and the other ten cubic centimetres olive oil (no A and D vitamins) daily. The developmental structure of the dental tissues of the first dog was perfect. At the end of six and a half years the condition of the mouth was almost normal. The condition of the mouth of the second dog was very bad; the mouth was dirty, the breath offensive, there was much tartar, with denudation and deep pockets containing much pus in many places. Two teeth had been shed and many were loose.

When 8 years old the periodontal tissues of the first dog were free from disease, while in the tissues of the second dog disease was still active, though the addition of vitamin D for one and a half years had delayed further progress of bone absorption.

As a result of these and twelve other experiments, Mrs. Mellanby concludes that periodontal disease can be prevented, and induced to varying degrees of severity, in dogs by dietetic means. The most effective means of preventing periodontal disease is the presence in the diet of abundant vitamins A and D in the early months of life; that is to say, during the period of development of the periodontal tissues. It cannot be stated definitely how long the special diet should be continued after weaning.

The best results in dogs were obtained when the good feeding lasted ten months, but even a period of three months conferred much resistance to the tissues so that they were fairly resistant to disease even when the vitamins A and D were deficient over long periods of later life.

The prevention of periodontal disease is very difficult if the early diet after weaning is deficient in vitamins A and D. Even when a diet rich in these vitamins follows, this early deficiency disease persists, but not to the same extent as when the deficient diet is continued in adult life.

Mrs. Mellanby's experiments have shown that general periodontal disease, including pyorrhœa, in animals can be prevented by specific dietetic treatment. Diets act primarily by controlling the developmental structure of the periodontal tissues and not by any direct or indirect effects concerned with bacterial decomposition in the mouth. Any external action of food in the mouth can only be of secondary importance.

Mrs. Mellanby points out that there is apparently no generally accepted standard for the supporting structures of the teeth. Most pathologists apparently agree that in the non-diseased the subgingival epithelium is thin and has no finger-like processes passing into the underlying corium, which is almost free from cells. The alveolar bone is also regular and compact.

Mrs. Mellanby's researches give an indication as to what is normal or perfect and what is abnormal in the microscopic structure of the periodontal tissues. They suggest most strongly that abnormality in the developmental structure commonly precedes any disease of these structures, where the word disease is used in the sense of pathological reaction to harmful agencies, whether external or internal. They also help to elucidate the vexed question as to whether pathological changes in the soft periodontal tissues, precede those in the hard structures or vice versâ. The developmental effects of the two vitamins A and D have been shown to be entirely different. Usually in this country deficiencies of these two vitamins go hand-in-hand because their distribution in food is closely similar. In tropical countries where the diet is often deficient in vitamin A the people experience so much sunshine on their exposed skin that they are generally assured a sufficient supply of vitamin D, especially in childhood. In these people the periodontal tissues would tend to develop abnormally, while the bony structures would be perfectly formed. In such cases disease of the soft structures would probably precede disease of the bone, though both might be ultimately affected. When the supply of vitamin D is deficient and that of vitamin A good, then presumably disease might start in the bone. When vitamin A is deficient the hyperplastic epithelium is likely to become the seat of infection which in some cases may be blood-borne.

The experiments seem to indicate that unless the amounts of vitamins A and D are very large, it is unlikely that the cure of periodontal disease will result from this treatment. For one of the animals developed periodontal disease although the diet contained abundant vitamins A and D for several years after their exclusion in the early period of life.

Many hypotheses have been put forward regarding the causation of dental caries in man, but according to Mrs. Mellanby little attempt has been made to establish any hypothesis either by experimental methods or by adequately controlled observations.

This unsatisfactory position is mainly due to the difficulty of producing dental caries in animals under experimental conditions, and to the difficulty of carrying out observations in human beings with only a single significant variant.

The earliest sign of caries in human teeth is usually a chalky appearance of the enamel, which may become pigmented. The enamel eventually breaks down and the dentine is exposed, but before this stage acids and organisms will have already penetrated into the dentine. In sections of a tooth diagnosed clinically as carious, the enamel and underlying dentine stain deeply in contrast with the surrounding undecalcified tissues. Cut and decalcified sections prepared by Gram's method show bacteria in the tubules and liquefaction foci in some areas. In "arrested caries," that is when a tooth with a live pulp which was previously carious has a smooth hard polished surface, ground sections do not stain readily and Mrs. Mellanby found bacteria within the dentine tubules in the hard zone.

Attempts to produce caries in dogs have with few exceptions failed. Diets containing glucose and other sticky fermentable foods, some with much and others with little vitamins A and D, were tested. On the suggestion of Dr. L. Colebrook, living cultures of *Streptococcus mutans*, considered by Clark and MacLean to be the organism usually concerned in the initiation of human dental caries, were rubbed on to the teeth or into artificial cavities, or more generally soaked in a little bread each evening. Agglutinins for the streptococcus appeared in the blood of three dogs out of fourteen treated in this way, but no signs of caries appeared after three years' feeding with the organism. Similar experiments made with the *Bacillus acidophilus* also failed.

Out of the whole series tested with various diets, only two had Gram-positive bacteria in the tubules and liquefaction foci. The diets of these animals were deficient of vitamins A and D, but no micro-organisms had been given.

When an erupted tooth is irritated either by caries or attrition, it reacts by producing some calcified tissue (secondary dentine) which acts as a protection to the pulp cavity. The secondary dentine so produced is subject to dietetic influences. Of thirty-four puppies whose diets were rich in vitamin D, twenty-eight responded to the stimulus of artificial attrition by producing much secondary dentine with no interglobular spaces. Of sixty-two puppies eating diets deficient in vitamin D, the teeth in all but two produced little secondary dentine or poorly calcified secondary dentine with many interglobular spaces. The majority of the tubules in the secondary and primary dentine in dog's and human teeth appeared to be continuous.

Mrs. Mellanby next studied the effects of diet on the dental structure in mammals other than the dog. In these investigations she again emphasizes the importance of a definite meaning in the use of the words normal and hypoplastic in regard to dental structure. The term normal is reserved for teeth which show macroscopically white, smooth, shiny enamel and microscopically well-formed enamel and dentine containing no interglobular spaces, and the term hypoplastic or abnormal for teeth showing any departure from this condition.

In the dentine of cetacea, interglobular spaces are found, but these were regarded by the late J. H. Mummery as being physiological rather than pathological. Mrs. Mellanby says these are degenerate mammals modified by their reversion to a marine habit of life, and arguments based on their structure can have little significance in relation to the dental structure of man.

One would expect horses' teeth to be imperfect as they are fed on substances containing the anti-calcifying factor and with little vitamin D to counteract this harmful influence. Mrs. Mellanby found teeth normal in some horses ; in others, small interglobular spaces were present in the dentine, probably due to deficiency of vitamin D when the teeth were developing. She sums up this part of the research with the statement that defects, including interglobular spaces similar to those so commonly found in man, are sometimes but not always found in the teeth of horses, monkeys and ferrets. The dietetic factors controlling the structure of rabbit's teeth are in general the same as those which control the structure of dog's teeth. Vitamin D in the diet is of great importance for the proper calcification of the teeth. With a deficiency of vitamin D the amount of calcium and the calcium-phosphorus ratio becomes significant. We drew attention to these points in our review of Part I of Mrs. Mellanby's Report.

The problem of the arrest and prevention of caries in human beings will be discussed in Part III, to which we look forward with great interest.

Clinical and other Notes.

TREATMENT OF DETACHMENT OF THE RETINA.

By Major R. M. Dickson, O.B.E.,
Royal Army Medical Corps.

Two recent cases in Millbank suggest the need of laying down a definite procedure that can be followed with confidence in the treatment of detachment of the retina.

There is a tendency to keep these patients confined to bed for prolonged periods. It cannot be too strongly emphasized that the chances of obtaining good results from treatment become progressively poorer with the lapse of time, and that early operation in suitable cases gives a very possible chance of success.

Cases occurring abroad should therefore be invalided home as soon as the diagnosis is established, if for any reason operation cannot be undertaken locally.

Professor Gonin, of Lausanne, has shown that those cases of detachment with a rent in the retina, which heretofore were thought to be the most hopeless, are in reality, thanks to the method of operation which he has devised, the most hopeful.

The method aims at finding the hole in the retina, carefully localizing it, and then sealing it with the electro-cautery.

In the preliminary investigation and preparation for operation it is essential: (1) to find the hole; (2) to determine the meridian in which it lies; (3) to estimate the distance of the hole from the corneal limbus.

(1) *The Hole.*—This requires careful search with a widely dilated pupil, as it is frequently situated at the extreme periphery of the ophthalmoscopic field of view, i.e., at the ora serrata. The hole may be at first hidden by a fold in the detached retina, and since the retina may move, several examinations may be necessary before it is discovered.

Though the hole is most frequently found in the detached portion of the retina, it may be situated in that part of the retina which is still attached. A careful search must, therefore, be made in both the attached and unattached areas, and the possibility of multiple holes must not be forgotten.

(2) *The Meridian.*—If, for example, the hole is found to be opposite 5 o'clock, a mark is made at the limbus at 5 o'clock, and another mark at the opposite side of the cornea at 11 o'clock. A line joining these two marks will pass through the hole. To mark the meridian, a minute incision is made with a Beer's knife, and Chinese ink rubbed in. Care must be taken not to disturb the alignment by rotating the eyeball with fixation forceps when the incisions are being made.

(3) *The distance of the hole from the limbus* is calculated in disc diameters from the ora serrata. The diameter of the optic disc represents 1·5 mm., the ora is 8 mm. from the limbus, and the furthest visible portion of the fundus is reckoned as 1 mm. from the ora, e.g., if the hole is found to be 2 d.d. from the extreme periphery, the distance from the limbus is $3 + 8 + 1 = 12$ mm.

Operation.—The following instruments are required : speculum, fixation forceps, strabismus scissors, Desmarre's retractor (small size), with a 1 mm. hole drilled through the middle of the blade, electric cautery with fine point, screw callipers, millimetre steel rule, 5 curved needles, 4 with No. 0 black silk and 1 with No. 1 black silk, needle holder, artery forceps.

First Stage.—Local anæsthesia is induced by the instillation of a four per cent cocaine solution, and subconjunctival injection of a two per cent novocain solution and adrenaline. A ten minutes interval is allowed after the injection before commencing the operation. In the meantime the direction suture (*le fil conducteur* of Continental writers) and the rotation suture are fixed.

Direction Suture.—A knot is made on the end of the No. 0 silk; the needle is inserted through a fold of conjunctiva to emerge at the distal ink mark; the suture is pulled through until it is caught by the knot, and it is then allowed to hang free.

Rotation Suture.—The No. 1 thread is inserted through a fold of conjunctiva and episcleral tissue to emerge at the proximal ink mark; it is pulled half way through, and the double thread is clamped with artery forceps. This is used to rotate the eyeball in place of fixation forceps.

The precise distance of the hole from the limbus is measured off in millimetres on the steel rule, and the screw callipers are fixed accordingly.

Second Stage.—The eyeball is strongly rotated by means of the rotation suture by an assistant. The distance from the limbus is roughly estimated with the callipers, and by an equatorial incision a flap of conjunctiva and episcleral tissue is dissected back, so that the centre of the flap is at the estimated distance.

Two sutures are inserted through both lips of the incision, and the ends left free, ready to tie.

The direction suture is threaded through the hole in Desmarre's retractor, the retractor inserted to pull back the flap, and the thread tightened until it is exactly in alignment with the proximal ink mark. (The edge of the rotation suture forms an additional guide.) The rotation and direction threads are then held by the assistant.

The field of operation is swabbed dry, and the electro-cautery should now be ready to hand. The distance from the limbus is measured off along the direction thread with the callipers, and the precise spot marked with the cautery. With the cautery at red heat, a deep groove is carefully and slowly made in the sclerotic in line with the thread, 5 to 6 millimetres in length, and with the marked spot as the centre of the groove.

An excellent modification is to make a cruciform groove, as, covering a wider area it enhances the prospect of sealing the retinal hole.

The making of the groove should occupy twenty to thirty seconds.

Finally, the central point is perforated with the cautery, the escaped fluid mopped up, and the cold cautery point inserted into the eye through the hole made, the current is then turned on strongly so as to cause the fluid to bubble for about five seconds.

Third Stage.—The sutures are tied to secure the flap, and the direction and rotation sutures are removed.

Notes.—The advantage of the drilled hole in Desmarre's retractor is that the threaded guide suture is in contact with the eyeball, and this facilitates precise measurement with the callipers.

The sclerotic should not be opened with a knife, as there is grave danger of intra-ocular hæmorrhage.

If the retinal hole is in line with a rectus muscle, the muscle may have to be resected and sutures placed in position ready to tie after the operation is completed; sometimes the muscle may be drawn on one side, or if the hole is under the tendon the cautery puncture may be made through this.

Posture in bed depends on the site of the retinal hole; if below, the patient is propped up in bed, and vice versa.

Both eyes are bandaged for twenty-four hours. The patient is kept in bed for seven days, and atropine ointment inserted once daily for three weeks.

I should like to record the fact that Sir William Lister, K.C.M.G., Consulting Ophthalmic Surgeon to Queen Alexandra Military Hospital, was the first to introduce Gonin's method of operation to this country.

Since this article was written a report has been published[1] giving the results of the first seventy-five cases operated on at Moorfields by Gonin's method. Thirty-two per cent of the cases were cured, with the retinal detachment back, and the visual field full, and sixteen per cent showed improvement either in the visual field or in visual acuity.

This is indeed a wonderful result in what was previously considered to be an almost hopeless condition.

---

[1] "Simple Detachment of the Retina." By Doggart and Shapland, *British Journal of Ophthalmology*, May, 1931.

A CASE OF PULMONARY TUBERCULOSIS AND ADDISON'S ANÆMIA.

By Captain F. McL. RICHARDSON,
Royal Army Medical Corps.

The patient, a soldier, aged 20, stated that his previous health had been excellent. He played football, and had won medals for long-distance running. He admitted, however, that since January, 1929, when appendicectomy was performed, he had not felt very well. He had been noticeably pale since coming to India early in 1930, and when transferred in April to Jalapahar, a hill station, at an altitude of about 8,000 feet, he began to get breathless and weak. He had no cough or night sweating, but lost weight slightly.

In May, 1930, he was admitted to hospital in Jalapahar for "tachycardia," and he was slightly anæmic at this time. In July he was readmitted with a mild pyrexia, and had an erythrocyte count of 4,480,000; on August 7 he was transferred to Lebong.

His family history furnished no suggestion of hæmopoietic disorders or of tuberculosis.

The conditions found by clinical and laboratory examinations were briefly as follows: No emaciation, extreme lemon-yellow waxy pallor, teeth sound, tongue not inflamed but its edges slightly indented by the teeth.

The heart was not enlarged; a soft systolic murmur was audible over the whole præcordium, maximal at the pulmonary area, and not conducted in any direction.

Blood-picture: Red cells 2,090,000, hæmoglobin 45 per cent, colour index 1·07, leucocytes 5,000, with relative increase of lymphocytes. A blood-film was not grossly abnormal; it showed poikilocytosis, anisocytosis, and slight polychromatophilia, but no nucleated red cells. A platelet count was not made, but the film contained very few platelets. The spleen was not enlarged.

The central nervous system was normal, no evidence of postero-lateral sclerosis. There were harsh vesicular breath sounds with medium pitched crepitations at the apex of the lower lobe of the left lung; some mucopurulent sputum, microscopic examination of which was negative. Blood-culture was sterile, and no hæmolytic streptococci were found in swabs from the throat and nasopharynx. Whilst the fasting juice of the stomach showed a low acidity, the acidity after a test meal was within normal limits. There was nothing to suggest sprue, nor any evidence of helminthic infection. A tentative diagnosis of Addison's anæmia was made, but treatment with raw and lightly-cooked liver and with liver extract produced no improvement, and his blood-picture steadily became more typical of true Addison's anæmia, until, on October 14, 1930, the red cells numbered 1,720,000, the colour index was 1·4, and a film contained

three megaloblasts and one normoblast, the changes in the red cells, already noted, being much more marked, punctate basophilia being added to them.

Meanwhile, his pulmonary condition had also progressed unfavourably, physical signs of pulmonary tuberculosis being present in both lungs, and tubercle bacilli in the sputum. On October 16, as he was becoming steadily more ill, and his blood-picture showed no signs of improving, despite treatment with liver, liquor arsenicalis, and graduated doses of direct sunlight, he was given a transfusion of whole blood. The patient stood the procedure very well, and within three days his temperature, which twelve days previously had been very high, was normal, and remained so, except for a few days of low pyrexia, until he left India three months later. He gained in weight, and improved sufficiently to be transferred to Calcutta for ultimate transfer to England. His red cells, however, never numbered more than 2,250,000, and his last count before leaving India was 1,160,000.

In this case there was no doubt as to the correctness of the diagnosis of pulmonary tuberculosis, but it is interesting to consider if the findings justified also a diagnosis of Addison's anæmia.

In the available medical literature no mention has been found of tuberculosis producing anæmia of a pernicious type, and the only grounds for doubting that this was a case of true Addison's anæmia appear to be:—

(1) The normal gastric acidity, and (2) the absence of any response to liver treatment, not even an increase of the reticulocytes being observed.

As regards (1), although achlorhydria is almost invariably a feature of Addison's anæmia, a normal acidity need not negative a diagnosis of this disease in the presence of pulmonary tuberculosis, in the early stages of which condition a hyperchlorhydria has been described by many writers. (2) The comparatively slight morphological changes in the erythrocytes at first and the late appearance of nucleated forms might suggest that the anæmia tended to be of aplastic type, in which case treatment would be unavailing. In favour of this is the age of the patient—Addison's anæmia being rare before the third decade of life—but strongly against it are the facts that nucleated and distorted forms were eventually prominent, that the leucocytes were of normal granular type, and that the patient was alive six months after the onset of the condition.

I consider, therefore, that pulmonary tuberculosis and Addison's anæmia co-existed in this patient, and that in all probability the anæmia was the primary condition, rendering him more susceptible to tuberculosis.

My thanks are due to Lieutenant-Colonel A. S. Littlejohns, D.S.O., and to Lieutenant-Colonel H. C. Winckworth, for permission to publish this case.

Echoes of the Past.

EVENTS IN INDIA, 1857-1858.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

The Persian War.

The honours, *Reshire, Bushire, Koosh-ab,* borne on the colours of the Durham Light Infantry, commemorate the part taken by their 2nd Battalion, formerly the Company's 2nd Bombay Europeans, in the Persian War. The remaining British regiments which participated were the 14th Hussars, the 64th (1st North Staffords) and the 78th (2nd Seaforth Highlanders). The exciting cause was the refusal of the Persians to evacuate Herat, and the first objective was Bushire in the Persian Gulf, which was occupied by a force sent from Bombay after some resistance on December 10. Major-General James Outram having arrived with more troops, an expedition to the mouth of the Euphrates followed, and a detachment, ascending the river in three steamers, defeated the enemy at Ahwaz. There were several minor engagements, in some of which a spirited resistance was offered, but our battle casualties were few. The main feature of the campaign was the cold, drenching rain and the mud, which literally tore the boots off the men's feet. That the sick-rate was a low one was much to the credit of Outram, who devoted infinite care to his men's well-being. The depressing conditions may have contributed to the suicide of the second in command and the naval commodore, which occurred within a few days of each other. Surgeon M. Stovell, of the Company's Service, was superintending surgeon; a field hospital accompanied the force, which had also its full regimental medical establishments and regimental hospitals. The greater part of the troops returned to India in April, where more serious work awaited them.

The Indian Mutiny.

The indiscipline of the native troops of the Bengal army, which for some years had been steadily increasing, culminated on Sunday, May 10, 1857, in a rising of the Indian regiments of the Meerut garrison. Though there were British troops in the station, the mutineers, who were joined by the disorderly element in the bazaar, were permitted, after sacking and burning the European bungalows in their lines and murdering many of their occupants, to march unmolested to Delhi. At that station, which was held by an Indian brigade, the regiments joined the sepoys from Meerut, massacred most of the Europeans in the civil station, and, having shot several of their officers, occupied the city. The survivors escaped to Meerut or Karnal. Outbreaks quickly followed in other stations, where officers and civilians with their wives and families were either murdered, closely besieged, or became fugitives on the countryside. Among the early victims

of the Mutiny were a number of officers of the Bengal Medical Department who were either killed outright or lost their lives in trying to reach the nearest British garrison.[1]

The British troops, of which there were nominally 38,000 in the East Indies, were at this time widely dispersed. Some were still in Persia, three battalions on the Bengal establishment were in Burma, four, with the bulk of the European artillery, were in the Punjab, three in the Simla hills, and one in Oude. There was no scheme drawn up for a general mobilization. The contractors on whom the Army depended for transport and supply were, in the general disturbance, not forthcoming. Medical organization, like that of the Army generally, was on regimental lines, and neither stores nor doolies could be produced off-hand to provide even for the small force which was hurriedly collected round Ambala. The Medical Departments of the three Presidencies were administered by their Medical Boards. The system was already recognized as unsatisfactory, and, six months later, the Boards were replaced by Directorates. Meanwhile, Dr. Edmund Tritton, one of the Calcutta Board, assumed the duties of Superintending Surgeon to the column assembled under General Anson, the Commander-in-Chief in Bengal.

The main centres to be dealt with were three: Delhi, Cawnpore, where 150 British soldiers with the civilians of the station were besieged in their cantonment, and Lucknow, the capital of Oude, where the 32nd, some gunners, and a few loyal native troops held out under Sir Henry Lawrence, the Commissioner. Of these, Delhi, as the centre of the rebellion, and the seat of the former Moghal dynasty, whose representative the rebels had made their nominal leader, was considered of supreme importance.

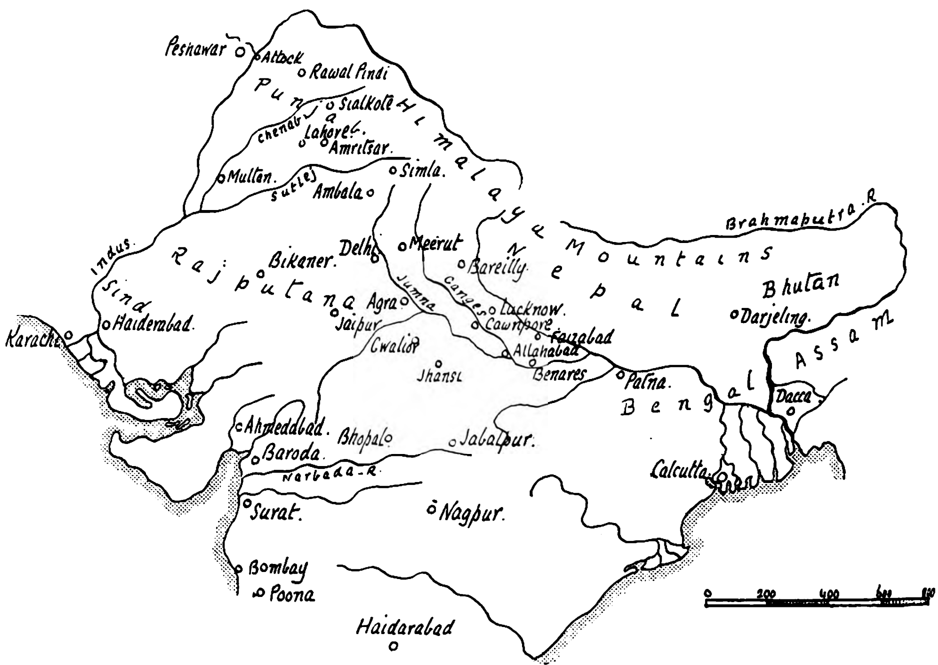
Delhi.

General Anson, who was in Simla when he received the news of the events at Meerut, ordered the 75th (1st Gordons) from Kasauli to Ambala, where there were already the 9th Lancers and some of the Bengal Horse Artillery. The Sirmur Battalion of Gurkhas was sent to join the Carabiniers and 60th at Meerut. The 1st Bengal Fusiliers (Munsters) were also brought up, arriving on elephants, with neither tents nor luggage. He himself arrived at Ambala on May 15, and led out the troops, including in the column the 60th Native Infantry. This corps was a few days later discarded as disloyal. On the following day he reached Karnal, where he died of cholera, introduced by the regiments marching down from the hills. Sir Henry Barnard then took command, and, marching on the 27th, reached Alipur on June 7, where he was joined by the Meerut troops and Hodson's

[1] These included Dr. Christie, 3rd Cavalry, Meerut, May 10; Surgeon Smith, of the Invalid Establishment, May 10; Assistant Surgeon A. Dopping (54th N.I.), Delhi, May 11; H. H. Bowling, Shahjehanpur; J. M. Hay, Civil Surgeon, and G. Hansbrow, Superintendent of the gaol at Bareilly, both hung after a form of trial, May 31; W. B. McEgan and wife (12th N.I.), Jhansi, June 8; Superintendent Surgeon K. W. Kirke, Gwalior, June 14.

Horse under Brigadier Archdale Wilson. Here also there arrived a light siege train and the Sirmur Gurkhas, bringing the number of fighting men up to about 3,500, with 22 field guns. The Gurkha was a far less familiar figure on the plains of India than he has since become. Writing of another detachment, their medical officer expressed a poor opinion of their probable value in the field. "They suffer much from the heat, as much as we do. They march with umbrellas and often with fans. They have no notion of keeping together, and are the dirtiest set I ever saw in my life. They eat ravenously and their food is uncooked, or nearly so. They take no care or notice of their sick."

There bad been many casualties from the heat. The British marched in their shirt sleeves with a white cover and curtain over their forage caps,



which afforded but poor protection from the sun. On June 8 Barnard engaged the mutineers in a strong position at Badli-ki-Serai, and drove them into Delhi at a cost of 182 casualties. The force then occupied the ruined cantonment on the Ridge. There was no question of a siege. The city was seven miles in circumference, and for the next two months the small body of troops was fully engaged in holding its own against constant attacks. In the sweltering beat the men had no other shelter than their bell tents, but two or three bungalows which had escaped destruction were available for the worst of the sick and wounded. Speaking of the medical arrangements, Lord Roberts, in "Forty One Years in India," wrote: "The Delhi Force was fortunate in its medical officers. Some of the best in the

Army were attached to it, and all that was possible to be done for the sick and wounded was done, but the poor fellows had a bad time of it. Those who could bear the journey were sent away to Meerut and Ambala, but, even so, with the relief thus afforded, the hospitals were terribly overcrowded. Anæsthetics were freely used, but antiseptics were practically unknown, consequently many of the wounded died, and few amputation cases survived." Barrack construction in the plains was at the time still in its infancy. The Indian troops built their own lines; the regimental hospitals were mainly thatched barrack huts with a mud floor hardened with cow dung. For some years, however, so-called sanatoria had existed at various places in the hills, such as Kasauli and Landour, and to these some of the more transportable cases found their way. Station hospitals there were none.

On June 27 the rains broke, and there was a great access of cholera cases. On July 5 Sir Henry Barnard was attacked, and died within a few hours. The flies swarmed. Roberts, as a D.Q.M.G., was responsible for camp conservancy, and the disposal of the bodies of dead transport animals he found an almost impossible task. The jackals helped, and he gratefully acknowledged the services of hundreds of adjutant birds who made an unwonted appearance in the district. Reinforcements came in driblets, but on July 22 the arrival of the Punjab Movable Column under Brigadier John Nicholson raised the number of effectives on the Ridge to nearly 8,000. In addition there were, in spite of evacuation, 1,535 sick and wounded. By September 6 all possible reinforcements had arrived, when the swelling sick list rendered a decision imperative as to whether an assault should be attempted or the force withdrawn.[1] General Wilson, now in command, hesitated. Apart from the risk of failure, he seems to have feared that success might mean the dissolution of his army, which would scatter about the city in search of loot. But on the early morning of the 14th the assault began. The men were told that all who fell were to be left on the ground. If the attack succeeded, doolies would be brought up; if it failed, wounded and sound alike were to be prepared for the worst. By evening a small portion of the walls was in our hands with a loss of 1,104 killed and wounded; by the 20th, after fierce street fighting, the whole city was won. Among the wounded was the heroic Nicholson, who was shot through the chest. The sack of Delhi had already begun, and the bearers who were carrying him away set down the dooley and went off to plunder. Lord Roberts, passing by, found him alone and in great pain. Collecting some bearers with difficulty, he despatched him to the hospital on the Ridge where he died nine days later.

The regimental surgeons accompanied the assaulting column. A regimental aid post had been established at the end of some of the streets, when

[1] As an example, the 52nd, which arrived from the Punjab three weeks before. 600 strong, mustered 245.

a party of rebels established themselves in one of the houses and commenced firing from the roof. Surgeon H. T. Reade of the 61st promptly drew his sword, and, calling upon the few soldiers who were near to follow, succeeded, under a very heavy fire, in dislodging the enemy from their position. Of the ten men who undertook this duty, two were killed and six wounded. Surgeon Reade received the Victoria Cross.

Lord Roberts wrote of the siege of Delhi: "The behaviour of the troops was beyond all praise; their constancy was unwearied, their gallantry most conspicuous; in thirty-two different fights they were victorious over long odds, being often exposed to an enemy ten times their number, who moreover had the advantage of ground and superior artillery. For three months, day after day, and for the greater part of the day, every man had to be constantly under arms, exposed to a scorching Indian sun, which was almost as destructive as, and much harder to bear than, the enemy's never ceasing fire. They saw their comrades struck down by cholera, sunstroke, and dysentery, more dispiriting a thousand times than the daily casualties in action. They beheld their enemies reinforced, while their own number rapidly decreased. Yet they never lost heart. The effective force at Delhi never amounted to 10,000 men. Of these 992 were killed and 2,845 wounded, besides hundreds that died from disease and exposure."[1]

The incidence of disease varied considerably in the different units. Cholera, which was never entirely absent, caused heavy wastage in the 8th, 52nd and 61st. The 60th, which was generally acknowledged to be the finest battalion at Delhi, suffered less. If there was one redeeming feature amid many others conducive to bad health on the Ridge, it was the absence of the temptations of the bazaar and the curse of idleness. Innes, in his "History of the 1st Bengal Fusiliers," notes that the sick-rate in his battalion was but little above that usual in cantonments, which he ascribes to the fact that the men were kept busy.

General Wilson in his despatch of September 22, 1857, stated: "With the medical arrangements of the Superintending Surgeon, B. Tritton, I have every reason to be satisfied and he is entitled to my cordial acknowledgments. . . . The labours of the Medical Department have been unceasing, notwithstanding there has not been at any time the slightest failure in the arrangements for the care and comfort of the very numerous patients." He also mentioned Officiating Superintending Surgeon C. McKinnon, in medical charge 1st Brigade H.A.; Surgeon J. H. Kerr Innes, 60th; J. P. Brougham, 1st Bengal Fusiliers; E. Hare, 2nd Bengal Fusiliers; Assistant Surgeons J. Clifford, 9th Lancers; W. F. Mactier, personal staff; and Surgeon D. Scott, medical storekeeper.

The following medical officers served with British regiments at Delhi.

6th Dragoons.—Assistant Surgeons Stuart Moore (fatally wounded), D. S. Smith.

---

[1] On October 19 there were present 9,699 effectives. 2,368 sick, and 617 wounded.

9th Lancers.—Assistant Surgeons J. J. Clifford, D. S. Smith.

52nd (2nd Oxford L.I.).—Surgeon W. J. Ingham, Assistant Surgeons C. A. Innes, H. A. Gogarty.

60th (K.R.R.).—Surgeon J. H. Kerr Innes.

61st (2nd Glosters).—Surgeon H. T. Reade, Assistant Surgeons R. McNab, C. M. M. Miller, A. Hoyle.

8th (King's Liverpool).—Surgeon F. C. Annesley, Assistant Surgeons T. J. Biddle, W. H. Yates.

75th (1st Gordon Highlanders).—Surgeons J. Coghlan (died on march), C. Dominichetti, Assistant Surgeons A. H. Fraser, S. A. Lithgow (wounded), W. S. Whylock.

1st Bengal Fusiliers (1st Munsters).—Surgeon J. P. Brougham, Assistant Surgeon Charles (both of the Company's Service).

2nd Bengal Fusiliers (2nd Munsters).—Surgeon E. Hare (Company's Service).

Corps unidentified.—Assistant Surgeon D. R. Rennie, A.M.D.

The battle casualties among the medical personnel were not excessive; Stuart Moore died from wounds received at the Battle of Ghazi-ud-din-Nuggur before Delhi was reached, Assistant Surgeon T. H. Woodward was killed August 31, Assistant Surgeon W. W. Ireland of the Bengal Artillery was on August 25 shot through the eye, the bullet passing below the brain and out behind the ear. He more or less recovered, and died in 1909.

The number of officers of the Bengal Medical Department present at one time or another during the siege seems to have been something like forty.

Lucknow.

At Lucknow Sir Henry Lawrence, the Commissioner in Oude, had foreseen the storm, and when it broke the British retired to the Residency and neighbouring houses which had been to a certain extent fortified for a siege and provisioned. After a small and rather disastrous engagement with the mutineers, the British troops and a few loyal sepoys were also withdrawn within the defences. The area occupied was a space of about thirty-seven acres with a perimeter of a mile. The space was filled by the Residency and various private houses, including that of Assistant Surgeon Joseph Fayrer, who had the post of Residency Surgeon. The houses were distributed as posts, each with its own garrison. The strength of the defending force was 1,700, of which 500 belonged to the 32nd (D.C.L.I.), nearly 200 being officers of mutinied regiments with other details including a detachment of the 84th, and 150 civilians. There were 800 natives and 600 women and children. The enemy outside was estimated at 6,000 and was continually reinforced.

On the second day of the siege Sir Henry Lawrence was wounded by a fragment of shell which burst in his room where he was writing. Fayrer, who first attended him, stated, "I found a large fragment had shattered the upper part of the thigh bone, passing through the thigh and gluteal

region of the left side. I believe also that the bones of the pelvis were injured. I consulted other medical men, including Dr. Partridge and Dr. Ogilvie, but all agreed that the injury was of too serious a nature to leave any hope of recovery." He died on the morning of July 4. On the 20th Major Banks, the second civil officer, was killed, when Colonel Inglis of the 32nd assumed chief command.

Apart from the fire of the enemy and the constant strain of watching the extended and weak defences with an inadequate force, the insanitary conditions prevailing contributed to the losses of the garrison. The followers were reduced by desertions, and few men capable of bearing arms could be spared for the work of conservancy. The stagnant pools caused by the rain could not be drained and bred mosquitoes; the offal and dead animals lying about attracted myriads of flies. The area in which comparative shelter from the heat and the enemy's fire could be obtained was limited; overcrowding resulted, and contagious disease spread. The banquet hall was turned into a hospital where similar overcrowding prevailed. There was a high case mortality, and all amputations proved fatal. Few children survived the siege. Colonel Inglis stated in his despatch, "Besides heavy visitations of cholera and smallpox, we also had to contend against a sickness which has almost universally pervaded the garrison. Commencing with a very painful eruption it has merged into a low fever combined with diarrhœa, and, although few or no men have actually died from its effects, it leaves behind a weakness and lassitude which, in the absence of all material substances save coarse beef and still coarser flour, none have been able to get over."[1]

The medical officers took their share of the fighting, besides performing their ordinary duties. The senior was Surgeon C. Scott of the 32nd, of whom one of the garrison wrote: "Though apparently rough, his arrival was always hailed with pleasure by every one in hospital. For some poor soldier he usually had a trifling present, and though he bestowed his favours with a degree of roughness bordering on rudeness, sometimes, he did so in order not to have the thanks of the recipient. The 32nd all looked to him as a father."[2] William Boyd was his assistant surgeon. The remaining officers, all of the Company's service, were Surgeon W. Brydon, of the 71st N.I., who had survived the Kabul retreat, and was severely wounded during the siege; Surgeon Ogilvie, the Sanitary Commissioner; Surgeon Campbell of the 7th Light Cavalry; Surgeons Pitt, 13th N.I., and Wells 48th; Assistant Surgeons: J. Fayrer, Residency Surgeon; R. Bird of the Artillery, S. B. Partridge, A. M. Greenhow, J. B. Macdonald, E. Darby, Hadow, and Mr. Apothecary Thomson. Macdonald died of cholera, and Darby was mortally wounded. Between June 30 and September 26, of the

[1] Surgeon Home of the relieving force found no definite cases of scurvy among the garrison. Fresh beef was issued throughout the siege, but green vegetables were unobtainable.

[2] Rees, "Siege of Lucknow."

fighting men, 140 Europeans were killed and 190 wounded. The strength had fallen from 927 to 577, showing that many others had died. Of the natives, 130 were dead and 230 had deserted. Of the women, 2 had been killed, 9 had died. Of the children, 53 had died. On September 25, Generals Havelock and Outram with reinforcements fought their way into Lucknow. The events leading to the First Relief of Lucknow, so called, may now be followed.

Early in June Benares with the supremely important military depot at Allahabad were secured by the energy and initiative of Colonel Neill with some companies of the Madras Europeans which had been brought by sea to Calcutta. The railway ran as far as Raniganj, about 120 miles, and the troops were entrained as fast as they could be disembarked from the flats in the river. So little was the situation appreciated by the railway officials that the stationmaster insisted that the train must be started before one of the companies, which was ten minutes late, had arrived. The guard and engine-driver were equally obstructive, and Neill promptly put them under a guard and took charge of the station. On arrival at railhead the men were pushed on in every conveyance that could be found. Neill himself reached Benares with a handful of his command on June 3. The sepoys resisted disarmament and opened fire on the British. They were dispersed and ruthlessly pursued into the surrounding country. A few days later the fort at Allahabad was reinforced and the whole district reduced to order. Mutiny and murder were punished with a firm hand, in some cases by hanging, in others by blowing from the guns. A medical officer has recorded his impressions of the last operation. "After the explosion the grouping of the men's remains in front of each gun was various and frightful. One man's head was perched upon his back, and he was staring round as if looking for his legs and arms. All you see at the time is a cloud like a dust-storm composed of shreds of clothing, burning muscle, and frizzling fat with lumps of coagulated blood. Here and there a stomach or a liver comes falling down in a stinking shower." It was indeed difficult to estimate the range of these fragments of humanity, which we read of elsewhere as ruining the magnificent uniforms of the Bengal Horse Artillery drawn up for the parade.

Neill, who had a proper contempt for the mutineers if firmly dealt with by a disciplined force, fixed on Cawnpore as his next objective, and had already despatched a small column in that direction when Brigadier-General Havelock arrived to take over command. A week later the relief force started along the Grand Trunk Road in pouring rain, 1,403 British and 561 Indian troops. It was the worst season of the year; most of the British had only winter clothing, but the Madras Europeans were provided with white smocks and trousers and had curtains over their forage caps. The road was one scene of desolation, every bungalow pillaged and burnt to the ground by the natives, in return for which all their villages were burnt down and the bodies of rebels were hanging by half-dozens from the boughs

of the trees on the roadside. The following composed the column: H.M. 64th (1st. N. Staffords), 78th (2nd Seaforth Highlanders), 84th (2nd York and Lancaster Regiment), the H.E.I.C.'s Madras Europeans (1st R. Dublin Fusiliers), R.A. (76), Bengal Artillery (40), Volunteer Cavalry (20), Sikhs and Irregulars (543).

At Fatehpur there was a brush with the enemy, and, as a foretaste of the future, there were twelve deaths from sunstroke. On the 15th the rebels were again routed with a loss on our side of twenty casualties. On arrival at Maharajpore it was decided to press on, leaving the field hospital and baggage behind. As Cawnpore was approached the men fell down in numbers from heat stroke and exhaustion. On the 17th Havelock fought his way in to find he had arrived too late. The column during the previous nine days had marched 126 miles. Apart from battle casualties, cholera had appeared, and there now remained a little over 1,500 men fit for duty.

The happenings at Cawnpore were briefly as follows. On June 6 the sepoys rose and proclaimed Nana Sahib, the adopted son of the last of the Peshwas, sovereign of the Mahrattas. The British under the command of Sir Hugh Wheeler, a veteran officer, were besieged in a feeble entrenchment thrown up round two barrack blocks in the cantonment.[1] These were one-storied buildings with thatched roofs, surrounded by an earthern parapet five feet high. The space was crowded, the heat intense, and the water supply from a well, which was under continual fire. A second well outside the parapet served as a cemetery, and received the bodies of 250 persons during the siege. On the fourth day the buildings, which gave some protection to the sick, wounded, and women and children, were set alight by red-hot cannon balls, forty helpless patients were burnt to death, and surgical instruments and medical stores destroyed. For twenty-two days the garrison held out against constant attacks and artillery fire, making numerous gallant sorties in which some of the enemy's guns were spiked. Rations were reduced to a handful of atta and dhal daily. At length terms were agreed to under which the survivors were to be transported in boats to Allahabad. The boats were fired on, those who were not killed outright were dragged ashore, the men were then killed, the women and children were hacked to pieces by sweepers armed with swords a fortnight later. The names of eight medical officers, with those of their wives and children, are found in the list of the garrison. Of these, Christopher Garbett, Superintending Surgeon, and Collyer of the 53rd N.I., died during the siege. W. R. Boyes, medical storekeeper, D. Macaulay, Artillery, H. P. Harris, Civil Surgeon, A. W. E. Newenham, R. D. Allen, and J. P. Bowling were murdered.

---

[1] 84th Regiment (60), 32nd (74), all invalids, Madras European Regiment (15), Artillery (59). Officers of Native regiments (100), women and children (400), civilians (about 100), natives (about 100).

The names of those who died at Cawnpore deserve honourable remembrance. Amid the shocking details of their ultimate fate, the gallant and spirited nature of the garrison's defence against overwhelming odds is liable to be forgotten.

Havelock spent a week in Cawnpore, while Colonel Neill with 250 men was brought up to take charge of the city. The General was in considerable anxiety as to the effect the halt would have on the men exposed after an exhausting march to the temptations of a captured town. He wrote to the Commander-in-Chief, "I have ordered all the beer, wine, spirits, and every drinkable thing in Cawnpore to be purchased by the Commissariat. . . . If it remained at Cawnpore it would require half my force to keep it from being drunk up by the other half, and I should not have a soldier in camp." As things were, there was great increase in sickness. On the 26th the river was crossed, but, after several skirmishes with the rebels, Havelock was compelled by diminishing numbers and the impossibility of disposing of his sick and wounded to return to Cawnpore. One sixth of his men had perished, half in battle and half by disease.[1] Of the 1,415 British remaining, 335 were in hospital and seventy more were unfit to march. The deaths were six a day, and the senior medical officer was constrained to point out that in six weeks the force would cease to exist. Havelock wrote, "The medical men yesterday recommended repose, but I cannot halt while the enemy keeps the field, and in truth, our health has suffered less fearfully even in bivouac than in cantonment." Nevertheless the column was now marched and fought to a standstill.

Shortly afterwards Sir James Outram came in with reinforcements, bringing the numbers up to something over 3,000, and, on the evening of September 18, leaving 400 convalescents to hold Cawnpore, Havelock recrossed the Ganges, marching for four days in heavy rain. On the 23rd, with slight opposition, he reached Alum Bagh within two miles of Lucknow, which was occupied, and here the field hospital and heavy baggage was deposited. On the 25th, advancing by a devious route, involving a circuit of some five miles and much street fighting, he reached the Residency. The only chance for those who fell was to be taken on in doolies. These, with the rearguard, were forced to take refuge in a building called the Moti Mahal, nearly a mile from the Residency, where they were closely besieged. The regimental medical officers of the 78th, Surgeon Joseph Jee and Assistant Surgeon V. M. McMaster, were hard put to it to keep the bearers together, and, with the help of the escort, to get the wounded under cover, in which work they displayed the utmost gallantry and devotion. A party was sent on the following day to extricate them. In removing the wounded, the convoy in charge of Surgeon A. D. Home of the 90th and his assistant surgeon, W. Bradshaw, was misled by their

[1] The deaths in the 78th from July 1 to December 31, 1857, were, in battle 94, from cholera 69, other causes 28.

guide, and was trapped in a small square where it came under heavy fire. The assistant surgeon in the rear of the convoy, ably assisted by his apothecary, Mr. Hurst, succeeded in extricating twenty of the doolies, which, with great difficulty, he conveyed safely to the Residency. Forty remained, the bearers of which had either been killed or had run away. With these remained also Surgeon Home and eight others, who, occupying one of the houses, for some hours kept the enemy at bay and to a great extent protected the helpless wounded. At length the house was set on fire, the party was driven to another refuge, and the wounded were cut to pieces or burnt to death in their doolies. Home and six survivors held out for over twenty-four hours, when relief came. All four officers above mentioned received the Victoria Cross.[1]

The casualties in the two' days fighting amounted to 119 killed, 339 wounded, and 77 missing, the last all being killed. The only fatality among the officers of the medical service was Assistant Surgeon A. H. Bartrum of the Artillery, whose wife was awaiting his arrival in the Residency.

After the arrival of the relieving force the defences were set in order and extended. The strain on the defenders was relaxed, but the siege continued. The field hospital was brought in under cover of night, but most of the medical stores remained in the Alum Bagh.[2] There were no medical comforts and chloroform had run out. The hospital was securely barricaded "without detriment to ventilation," tents were pitched, and fresh buildings taken up for the hospital patients, whose number was now increased from 130 to 627. Old tents were cut up for bedding. Surgeon Scott of the 32nd continued to perform the duties of superintending surgeon. Under the direction of Dr. Ogilvie, the Sanitary Commissioner of Oude, the defences, including the posts recaptured from the rebels, were reduced to something like a sanitary condition.

It will be seen that Havelock's relief of Lucknow was no relief at all, and Sir Colin Campbell, who arrived at Calcutta in August as Commander-in-Chief, realized that the withdrawal of the garrison was the most urgent and pressing operation to be undertaken. Various reinforcements had come in, but nothing was ready. He arranged for all fresh units landing in India to be issued with white cotton clothing, and issued a memorandum on clothing, diet, exercises, hours of sleep, etc., for their instruction. Regiments were pushed up country as fast as possible, usually by bullock dak, in carts containing six men each, and with relays of bullocks every ten miles. In November, 4,500 men had been collected at Cawnpore, and, leaving General Wyndham with an independent force to look after that

[1] Assistant Surgeon Bradshaw was selected as the recipient by the regiment, which was granted a V.C. for disposal.

[2] The wounded left on the 25th with Surgeon Innes of the 84th and Dominichetti of the 75th, sixty-four in number, remained there. Both these surgeons were mentioned in the Commandant's despatch.

city, Sir Colin advanced towards Lucknow. Of this column, Dr. J. C. Brown of the Bengal Horse Artillery was the Superintending Surgeon. On November 9 they reached the Alum Bagh. Working round the outskirts of the town, the Dilkusha Palace, with its walled inclosure, was then occupied. Here the Field General Hospital was placed. About the same time General Headquarters was established in the Martinière College. The next objective was the Sikandar Bagh, which was carried on the 16th by the 53rd (1st King's Shropshire L.I.), the 93rd (2nd Argyll and Sutherland Highlanders), and the Sikhs. The historian of the 93rd gives some details of the work of their medical officers. "The regimental hospital had been established by Dr. Munro early in the day beneath the walls of the Sikandar Bagh and, through the struggle and in the midst of the hottest fire, he, as well as his assistants, Sinclair, Menzies, and Bell, were to be seen exposing themselves fearlessly in attendance on the wounded."[1]

Fighting continued all the following day, fresh positions were won, and the troops took up positions to cover the withdrawal of the garrison from the Residency. There were a thousand helpless persons, sick, wounded, women, and children, and the removal of these in the face of the enemy was a most delicate operation; but, before dawn on the 23rd, they were safely assembled at the Dilkusha. To provide sick transport, the regimental doolies were requisitioned, the patients in the regimental hospitals along the line of evacuation having been first moved to the Dilkusha. From here they were picked up again when the force withdrew.

On the 27th, leaving General Outram with a few troops to hold the Alum Bagh, Sir Colin marched towards Cawnpore with his enormous convoy. The march was an anxious one, for news had come in that Windham had been assailed by the Mahratta leader, Tantia Topi, and driven into his entrenchment. The bridge over the Ganges was secured and, after allowing sufficient time for the women and sick to get well on the road to Allahabad, the enemy was attacked and dispersed, with a loss to ourselves of no more than ninety-eight casualties. The losses of Sir Colin Campbell's force by the enemy's action were not severe. Between November 12th and 22nd there were 123 killed and 429 wounded, the strength being about 4,500. Surgeon Scott and the nine other surviving medical officers of the original garrison received the thanks of the Governor-General, who also acknowledged the good service rendered by Surgeon J. C. Browne of the Bengal Horse Artillery, Superintending Surgeon of the relieving force. Browne, Brydon and Ogilvie received the C.B. General Windham in his despatch mentioned Senior Surgeon Elliot, C.B., of the Royal Artillery, his Principal Medical Officer.

We will now enumerate the officers of the British Medical Service who took part in the above operations so far as they can be ascertained.

---

[1] Burgoyne, "Historical Records of the 93rd."

Lucknow Garrison.

32nd (1st D.C.L.I.) Surgeon Charles Scott,[1] Assistant Surgeon William Boyd.[1]

Havelock's Column.

R.A., Assistant Surgeon J. Irvine[1]; 5th (Northumberland) Fus., Surgeon W. K. Swettenham (W), Assistant Surgeons T. R. Whitty, F. Collins, M. Grant; 64th (1st N. Staffs), Assistant Surgeon E. Lundy; 78th (2nd Seaforth Highlanders), Surgeon Joseph Jee,[1] V. M. McMaster,[1] T. Carew (W), Evans; (32nd attached), A. W. Beveridge; 84th (2nd York and Lancs), Surgeon F. W. Innes,[1] Assistant Surgeons J. T. La Presle, G. B. Poppelweel; 90th (2nd Cameronians), Surgeon A. D. Home,[1] Assistant Surgeons W. Bradshaw,[1] R. W. Jackson, C. R. Nelson (died September 18, 1857).

Colin Campbell's Force (*November* 9 *to December*, 6, 1857).
(Excluding the above.)

Superintending Surgeon J. C. Browne, Bengal H.A.,[1] P.M.O. British Troops East of Lucknow, Staff Surgeon J. C. G. Tice,[1] Staff Surgeon 2nd Class P. J. Clarke.

2nd Dragoon Guards, Surgeon H. H. Massy, Assistant Surgeons L. H. Robotham, R. F. Andrews; 9th Lancers, Assistant Surgeons S. Fuller, A. McArthur (W); R.A., Senior Surgeon R. C. Elliott, C.B.,[1] Assistant Surgeon J. Barker; 8th (King's Liverpool), Surgeon F. C. Annesley, Assistant Surgeons C. Domnichetti,[1] W. H. Yates; 23rd (R. Welch Fus.), Surgeon P. Laing, Assistant Surgeon H. T. Sylvester, V.C.; 34th (1st Border), Assistant Surgeons R. J. Worthington, W. Hayward, W. T. Paliologus; 38th (1st S. Staffs), Surgeon T. F. Wall, Assistant Surgeon T. Wright; 42nd (1st Black Watch) Surgeon J. S. Furlong, Assistant Surgeons A. Maclean, A. Hooper; 53rd (1st K.S.L.I.), Surgeon J. Grant,[1] Assistant Surgeons R. H. Beale, R. Hungerford; 64th, Assistant Surgeon R. McNab; 70th (2nd East Surrey), Surgeon John Fraser, Assistant Surgeon Joseph Watts; 82nd (2nd S. Lancs), Surgeon H. D. Fowler, Assistant Surgeons R. W. Carter, W. H. Muschamp; 88th (1st Connaught Rangers), Assistant Surgeons T. R. Williams, W. W. Meade; 93rd (2nd Argyll and Sutherland Highlanders), Surgeon W. Munroe, Assistant Surgeons W. Sinclair, R. Menzies, J. N. Bell; Rifle Brigade, Assistant Surgeons J. Reade, Alexander Guthrie, H. M. Fraser.

After the Battle of Cawnpore Sir Colin Campbell proceeded to clear the country between the Jumna and the Ganges, in order to secure the communications between the North-West Provinces and Calcutta. Reinforcements continued to arrive from England, and in March, 1858, he advanced again on Lucknow, having some 30,000 men at his disposal. He had a full medical staff with his army. Superintending Surgeon Brown

[1] These were mentioned in despatches.

was still with the force, and a Queen's officer, John McAndrew, whom we first met in Afghanistan as a most efficient regimental surgeon, was Inspector of Regimental Hospitals, British Troops. During the autumn Dr. Forsyth had become Director-General of the Medical Department at Calcutta, and Inspector-General William Linton had assumed the office of Inspector-General of British Hospitals.

After twenty days' fighting the rebels were cleared out of Lucknow, our casualties during that time amounting to 127 killed and 595 wounded. There was considerable sickness, but there were now ample stores, medicines, and attendants to cope with it. The regimental hospitals established at Lucknow are described as most efficient and creditable to the Medical Department. "For every wounded or sick man there was an attendant with a hand punkah to brush away the flies." Meanwhile, in Central India, Sir Hugh Rose was conducting a campaign probably more strenuous and exhausting to those engaged than any other in those strenuous two years.

(*To be continued.*)

Current Literature.

THE PARIS CORRESPONDENT. **When should Anti-tetanus Serum be Given?** The *Lancet*. 1931, i, 1049.

This question was reported on to the Academy of Medicine of France by a commission of twelve members: MM. Roux, Vaillard, Dopter, Vallée, Walther, Bazée, Hartmann, Balthazar, Faure, Mauclère, Auvray and Gosset. In April, 1931, they reported that they had unanimously come to the following conclusions, which were also agreed to by the Academy:—

The most thorough cleansing and disinfecting of wounds, especially of lacerated wounds, is essential, as is also the removal of foreign bodies. Anti-tetanus serum should be given for all lacerated wounds, and for less serious wounds containing foreign bodies or soiled with earth. The serum should be given for all subungual wounds and for even slight wounds of the feet. Serum treatment need not be used in superficial, easily-cleansed wounds not complicated by foreign bodies or by earth contamination.

One of the statements made by Roux in his memorandum was that where foreign bodies cannot be removed at once, there should be undertaken active immunization by Ramon's tetanus anatoxin. He advised that, after the wound had been cleansed and dressed, the first injection of anatoxin should be given, followed a quarter of an hour later by the ordinary injection of anti-tetanus serum; then, fourteen days later, a second injection of anatoxin should be given and, fourteen days later, a third and last injection. Roux added, "It is superfluous to insist on the advantage of active immunization should war break out."

Shortt, H. E., Smith, R. O. A., Swaminath, C. S., and Krishnan, K. V. **Transmission of Indian Kala-Azar by the Bite of** ***Phlebotomus Argentipes.*** The *Indian Journal of Medical Research.* 1931, xviii, 1373.

The writers, members of the Indian Kala-Azar Commission, have developed methods of feeding phlebotomus flies on kala-azar patients and then on Chinese hamsters. This work has already been recorded in the *Indian Journal of Medical Research.*

They had also done much work on the development of *Leishmania donovani* in *Phlebotomus argentipes* and had formed the opinion that the bite of that insect transmitted kala-azar to man; but many experiments on man and lower animals had failed to prove the theory.

The writers claim to have at last succeeded in transmitting kala-azar from man to the Chinese hamster by *P. argentipes.* They give no details as to the technique of the experiment, as they say it was exactly the same as that which they had already described.

The feeding experiment was begun on September 19, 1919, and there were 144 feeds by *P. argentipes.* Of the flies used six were known to be non-infected and thirty-eight to be infected, while the condition of the 100 remaining was unknown.

Post-mortem examination of the infected hamster was made about seventeen months after the beginning of the experiment, but as the spleen was not enlarged the writers are of opinion that infection took place late in the series of feeding experiments. Microscopic and cultural results were positive.

Experiments were made on forty-two hamsters on the same lines and, since only one became infected, the writers conclude that the infection-rate by this method of transmission is low. They also conclude that such a low infection-rate would account for the slow spread of the disease in man in non-epidemic periods, whereas during epidemics, with large numbers of cases, many flies become infected and transmissions are more numerous.

They consider it possible that in epidemics the rapid succession of transmissions from man to fly and from fly to man leads to a rise in virulence of the organism.

The writers now believe that their previous lack of success may have been due to the fact that their experiments, although on a large scale, were made when the epidemic of the disease was dying down, with the *L. donovani* probably becoming less virulent, and that this theory can only be tested should another epidemic occur.

Badger, L. F. **Significance of Positive Wassermann and Kahn Reactions in Leprosy.** *U.S. Public Health Reports.* 1931, 46, 957.

Extracts are given from literature on the occurrence of positive Wassermann and Kahn reactions in leprosy and, from the somewhat conflicting

evidence, the author concludes that there is a reagent in the sera of some lepers that will "fix complement in the presence of the Wassermann and Kahn antigens."

The author's own observations were made on 207 lepers over the age of 10 in hospital at Honolulu. 20·2 per cent of these cases gave a positive Wassermann reaction and 27·5 per cent gave a positive Kahn reaction, and when fifty-six were retested, some up to three times, the percentage of positives by one or both tests rose to 34·8.

In a neighbouring general hospital for non-lepers Wassermann and Kahn tests were made and positive results were only one-third as numerous as in the leper hospital, though the patients in both were from the same classes.

The author had some difficulty in analysing the results according to the types of leprosy, as he found that in Hawaii practically all the lepers had both neural and dermal manifestations. He classified the cases according to the predominating symptoms, but could find no difference in the results of serum examinations in the two groups.

Wassermann and Kahn tests were done on patients at various times, up to several years, and it was found that the reaction became more intense as the disease progressed, or that in a patient at first negative a positive reaction might develop. On the other hand, it was found that the intensity of the reaction decreased with clinical improvement and in some patients, when the disease became quiescent, a positive reaction became negative. There was no evidence of syphilis in these patients and they were not being treated for that disease.

Toullec F., & Riou, M. **Duodenal Intubation in *Clonorchis sinensis* Infections.** *Bulletin de la Société de Pathologie Exotique.* 1931, vol. xxiv, p. 286.

The writers, working in the medical clinic of the École de Santé Coloniale at Marseilles, found that in many cases where they suspected infection with *Clonorchis sinensis* they could get little clinical evidence, and on examination of smears made from the stools they could find only, perhaps, one egg in six or seven smears. They then extracted bile from the patient by means of an Einhorn's tube, and examination of the bile showed large numbers of eggs of the worm.

Lumsden T. **Tumour Immunity: the Effects of the Eu- and Pseudo-globulin Fractions of Anti-Cancer Sera on Tissue Cultures.** *The Journal of Pathology and Bacteriology.* 1931, vol. xxxiv, p. 349.

In papers published in the *Lancet* (1924-26), Dr. T. Lumsden stated that after devising a method of culturing normal and cancer cells in a liquid medium, he found the only reagents having a specific affinity for cancer cells were anti-cancer sera produced by inoculating the cancer of one species (e.g., man) into a heterologous animal (e.g., sheep). When these

anti-cancer sera were applied to tissue cultures of normal and malignant cells taken from an animal of yet another species (e.g., mouse or rat), the malignant cells were killed in a few minutes, but the normal cells survived and continued to migrate and divide.

When, however, a sub-lethal dose of such a serum was inoculated into the general circulation of a cancerous mouse or rat, the growth was little, if at all delayed. The cause being that the serum was too much diluted by the body fluids to affect the cancer cells. When the circulation was stopped in the tumour and the anti-serum then injected into it, the results obtained *in vitro* were seen and the tumour was destroyed.

When an implanted tumour was cured in this way the animal became highly resistant, and subsequent implantations of active tumour cells into any part of the animal failed to grow. It was thought the treatment damaged a number of the cancer cells so that when their products were absorbed into the animal's general circulation they acted like a vaccine and immunized the animal.

It is not feasible to isolate human tumours of the neck, prostate and digestive track in this way, therefore Dr. Lumsden endeavoured to concentrate the anti-sera and render them so non-toxic that an adequate concentration of them in the tumour area might be obtained without shutting off the general circulation.

In the serum of an animal which has been frequently inoculated with fragments of heterologous cancer three factors are found to be present:—

(1) A very labile cyto-toxin body (heterotoxin) which is lethal to all heterologous cells. This is normally present in the serum of untreated animals.

(2) Anti-malignant cell bodies which have a specific affinity for cancer cells whatever their source. These can be destroyed by heating the anti-serum to 56° C. for six to eight hours.

(3) Anti-species bodies lethal to normal as well as to malignant cells of the species or group from which the cancer cells used as an antigen were taken. These bodies are relatively stable and resist heating to 56° C. for forty to sixty hours.

All these toxic substances require complement to cause chromatolysis and rapid death. In the absence of complement they cause agglutination of the cells and not infrequently a precipitation reaction and gradual death are observed.

Dr. Lumsden first made experiments to determine whether each of the above factors was demonstrable in the euglobulin or pseudoglobulin fraction, or in both or neither.

Fractioning as a means of concentration and purification was suggested in 1927 by Lumsden's co-workers at the Lister Institute, and in 1928 he found that euglobulin precipitated from anti-cancer serum brought down with it the bulk of the anti-malignant cell bodies.

The euglobulins are prepared by dilution of the serum with ten times

its bulk of distilled water and saturation with carbon-dioxide gas at 0° C. The pseudoglobulins are prepared in the usual way by precipitation with ammonium sulphide and dialysation.

From sheep and rabbits' normal serum the euglobulin and pseudoglobulin factors were isolated and tested on cultures of normal and malignant mouse cells growing together in a drop of serum. The euglobulin factor was found to be toxic to both the normal and cancerous mouse cells, but much less so than the original sheep serum. The pseudoglobulin factor was entirely innocuous to both the normal and cancerous cells. Most of the heterotoxins were destroyed in the process of fractioning, and any remaining active existed in the euglobulin fraction.

In order to locate the anti-malignant cell-bodies and the anti-species bodies over two hundred experiments were made with different anti-cancer sera. It was then found that all the anti-malignant cell-bodies were contained in the euglobulin fraction and did not appear to have undergone appreciable diminution during the process of fractioning. The anti-species bodies were mainly confined to the pseudoglobulin fraction. The occasional slight toxic effect of the euglobulin fraction on normal homologous tissues might be due to heterotoxins or to the presence of some pseudoglobulin from insufficient washing of the euglobulin precipitate.

By redissolving the euglobulin precipitated from an anti-serum, an almost pure solution of the anti-malignant bodies can be obtained in a very much more (about ten times) concentrated form. On account of the absence of the anti-species bodies and heterotoxins in it, the redissolved and concentrated euglobulin fraction is much less toxic when inoculated into a living animal. The specificity of such solutions is of a very high order, and absolutely constant results have been obtained and demonstrated at the London Hospital. The anti-malignant cell-bodies become inert if kept for a day or two at laboratory temperature, hence only freshly precipitated euglobulin must be employed for treating tumours.

Dr. Lumsden considers that his experiments demonstrate beyond reasonable doubt the existence of anti-bodies having a specific affinity for cancer cells.

WATSON CHALMERS. **The Vital Factor in Diet: a Theory of the Nature of Vitamins.** *Edinburgh Medical Journal.* 1931, vol. xxxviii, No. 6, p. 91.

One of the objects of this paper is to put forward an hypothesis regarding the nature of vitamins. The author states that in nature vitamins are found only in the vegetable kingdom. Vitamins in animal tissues and in milk are derived from the vegetable foods consumed. The solar energy acts on the cells of the plants and initiates the chemical energy which promotes the healthy growth, maturity, and reproductive processes of the plant. This energy, in accordance with the law of the conservation of energy, is passed on to the animal kingdom when the vegetable food is consumed.

In his experiments Dr. Watson found an immediate and dramatic recovery brought about by the use of a bread and milk dietary in rats previously fed on abnormal diets. He attributed this recovery to some vital property in the milk which enabled the tissue cells to resume their normal growth. The changes were not due solely to an action on calcium nutrition, but to the specific vital energy in the milk which initiated the chemical changes essential to growth. Irradiation of milk by ultra-violet rays imparts to the milk a specific vital property capable of promoting the rapid recovery from rickets. But as the laboratory assay of irradiated milk reveals only a very slight increase of anti-rachitic property, Dr. Watson concludes some vital property has been added to the milk which is not represented by the present laboratory test for vitamin D. In support of this theory he refers to the valuable results obtained with the Gerson dietary which contains an abundance of fresh fruit and fresh vegetable juices and other foods rich in the recognized "vitamins." The caloric value of the diet is disregarded as the accepted view that caloric value and energy are synonymous is considered to be erroneous. Heat energy is stated to be not the same as vital energy ; it is no longer possible to describe a diet correctly in terms of heat energy (calories), ignoring the essential part played by the vital energy of the food.

Dr. Watson also bases his thesis on a consideration of "The present accepted position of physical science *re* the relation of matter to radiation." He says that colours are acquired by flowers and vegetable life through the selective action of the cells of the plants for the specific wave lengths required by them for their development and growth. The vital energy of the sun is absorbed by the cells and transformed into chemical energy which promotes the normal growth and development of the tissues. These activated cells hold some of the original vital energy, and when the tissues are consumed by man the energy is transmitted to him as a so-called vitamin.

Dr. Watson thinks the various known deficiency diseases may arise from the absence in the dietary of the specific forms of energy represented by specific parts of the electro-magnetic spectrum. In this connection he points out that Webster and others have already indicated that in the production of vitamin D by the irradiation of ergosterol, the analysis of the spectrum points to activity of wave lengths round 2,800 μ. He says that the processes in commercial use for the preservation and preparation of foods and some of our methods of cooking are ill adapted to preserve the vital property essential to healthy nutrition.

DOPTER, CH. **Combined Anti-typhoid and Anti-diphtheria Prophylactic Vaccination in the Army.** *Bull. de l'Acad. de Médecine.* 1931, cv, 794.

Diphtheria had been prevalent for some years in various units and garrisons of the French Army and it was decided to employ active

immunization, since all the other methods of combating the disease had proved insufficient to reduce its incidence.

Inspecteur Médecin Dopter points out the great loss in training and in money caused by diphtheria, and he mentions the rise in incidence of the disease twice a year after the new recruits join their regiments.

In 1927 in the French Army the value of prophylactic injections in diphtheria was recognized and voluntary immunization was allowed, but compulsory mass inoculations were not sanctioned except in cases of necessity, when permission of the Minister had to be obtained.

Between 1927 and 1930, 7,000 individuals, chiefly those employed in hospitals and the families of officers and non-commissioned officers, were vaccinated, and amongst these there have been only four cases of diphtheria, and these four were mild.

Early in 1930 it was decided to employ mass inoculation in several units: first the 9th Regiment of Cuirassiers at Lyons, the 15th Battalion of Chasseurs Alpins at Barcelonnette and the 2nd Regiment of Zouaves at Oudjda, and later the 5th Regiment of Cuirassiers at Pontoise and the 7th Battalion of Chasseurs Alpins at Albertville were immunized.

The system employed was to examine the recruits by the Schick test, and then to immunize those who gave a positive reaction.

Anti-typhoid inoculation of recruits is compulsory, and Dopter, with the permission of the Commission supérieur d'Hygiène et d'Épidémiologie Militaire, decided to combine the anti-typhoid vaccine with the diphtheria anatoxin and inject them together.

Ramon had shown in 1925 that the addition of powdered tapioca to diphtheria and tetanus anatoxin acted as an irritating substance and led to an increase in the amount of antitoxin produced in horses. Ramon and Zoeller then added T.A.B. to diphtheria anatoxin for human injection and they, and later others, found that there was an increase in the immunizing power, as shown by Schick reactions.

The injections were given to the recruits as follows :—

First injection, 1 cubic centimetre T.A.B., and 0·5 cubic centimetre anatoxin; second injection, 1 cubic centimetre T.A.B., and 1 cubic centimetre anatoxin ; third injection, nil, T.A.B., and 1·5 cubic centimetres anatoxin.

The second injection was given eighteen days after the first, and the third fifteen days after the second. However, in the case of the regiment stationed at Oudjda, one cubic centimetre of T.A.B. was given in all three injections on account of the prevalence of enteric fevers there.

The mixture was made at the time of injection, the T.A.B. being drawn up into the syringe and then the anatoxin.

At Lyons diphtheria had been endemic for many years, and in the 9th Regiment of Cuirassiers stationed there, there were 123 cases between December, 1928, and March, 1930. In May, 1930, 250 recruits were tested ; 169 were found to be Schick-positive, and of these 117 received

three injections of T.A.B. plus anatoxin by June 18, 1930, while in addition seventeen "rhino-vaccinations" were done. On May 20 there was a case of diphtheria, and another on the 21st in recruits who had received one injection. A case also occurred in a recruit who had received a rhino-vaccination only. There were no more cases till November, 1930, and up to February, 1931, there were only eight cases, all in unvaccinated men; two in old soldiers and six in recruits of the last batch, which was not inoculated. In other units in the same garrison diphtheria was prevalent during this time, there being thirty-two cases in one regiment after the arrival of recruits.

In the 15th Battalion of Chasseurs Alpins at Barcelonnette in August, 1929, there were seventeen cases of diphtheria in one outbreak and twenty-six carriers were isolated; in November there were several cases; in December forty-seven, and twenty-four more up to March, 1930. Fifty-nine recruits completed prophylactic injections in June, 1930; from then till the end of the year there were only a few cases and none in the immunized men.

In the 2nd Regiment of Zouaves at Oudjda the disease had been very prevalent; in the four years before inoculation was begun the numbers of cases were 147, 100, 60 and 112. In May, 1930, 238 out of 424 recruits were found to be Schick-positive and 199 of these were then immunized, the third injection being given on June 16. Up to the end of December, 1930, there were sixteen cases of diphtheria in the regiment and of these two were inoculated men, two months after they were inoculated, and were mild cases.

In the two other regiments 225 and 116 recruits were vaccinated and no cases of diphtheria appeared among them.

Dopter notes that among the cases of diphtheria several were in recruits who were Schick-negative when tested, and he considered it possible that the strenuous training of recruits may have led to a diminution in the resistance of these patients. He draws attention to an experiment made by Zlatogoroff and Kostereff, who tested men by the Schick and by the Dick reactions five days before a forced march, just after the march and again ten days later. They found the highest number of positive immediately after the march.

The author discusses the incidence of diphtheria among the non-immunized old soldiers after the vaccination of recruits.

No case of typhoid fever developed in the protected men, and Dopter considers that the T.A.B. vaccine injected with anatoxin was as efficacious as when injected alone.

The injection of the two prophylactics together saved time, disturbed the training of recruits less than if two series of inoculations were given, and the reactions produced were no more numerous or severe than with separate inoculations.

Reviews.

INJURIES AND SPORT. By C. B. Heald, C.B.E., M.A., M.B., M.R.C.P. London: Humphrey Milford. Oxford University Press. 1931. Pp. xxiv + 543. Price 25s.

It was a brilliant idea on the part of Dr. Heald to write a book with the above title. That serious risks occur in all kinds of sport is only too obvious to us all, and football in the Army, to mention only one "sport," leads to an enormous amount of time for training being lost on account of its devotees being admitted to hospital.

Chapter I gives a very careful description of the latest work on "Repair as a Repetition of Development." Much of the theory expressed here is the work of Hartwell of the Mayo Foundation, who believes that the "repair cell" is an undifferentiated cell exuded from the circulating blood, with all the potentialities of forming bone, cartilage, tendon, etc., according to certain local conditions.

Thus if an injury involves bone, this repair cell finds itself among bone cells and therefore proceeds to lay down bone. In a complicated injury, such as a compound fracture, indiscriminate repair with adhesions between normally separated structures may result, unless the surgeon has reconstituted the various layers in order to give the repair cells a fair chance.

In the next chapter there is a description of the development and repair of various structures.

A great deal of the book is devoted to electro-therapeutical and electro-physical treatment, as one would expect from an author who is not only an expert in these subjects, but an enthusiast.

There is a most valuable chapter in which "Factors modifying recovery" are discussed.

The injuries caused by certain games are fully described and the treatment suggested is excellent, as are the illustrations given.

The book is well conceived and most interesting reading. It should prove of great value. The regional indices are deserving of mention owing to their ingenuity.

The book can be strongly recommended. J. H. M. F.

DISEASES OF THE TONGUE. By Walter G. Spencer, M.S., F.R.C.S., and Stanford Cade, F.R.C.S. London: H. K. Lewis and Company, Ltd. 1931. Pp. xvi + 561. 20 coloured plates and 123 illustrations in the text. Demy 8vo. Price 35s. net.

The appearance of a third edition of this book after an interval of thirty years appropriately fills a gap in the medical literature of this subject. The present volume has been entirely rewritten, and should form a standard reference book on the tongue for some years.

A very large amount of space is rightly given to the diagnosis and treatment of new growths which is essentially a field for the specialist in advanced surgery.

The general practitioner will, however, find much useful information in the first part of the volume which deals with the wide variety of disease in which pathological states of the tongue and mouth may be present.

We would, however, venture to point out to the authors that the description of sprue on page 105 not only voices opinions which have long been discarded, but is misleading at almost every point touched upon, and the complete recasting of this paragraph would remove what is at present a disconcerting blot upon an otherwise excellent treatise.

There is appended a section giving the results of operative and radium treatment in 217 cases of epithelioma of the mouth and tongue, which afford great hope that a satisfactory treatment in early cases of this terrible affliction is at last in sight.

THE MEDICAL ANNUAL, 1931. Bristol: John Wright and Sons, Ltd. Many text illustrations and 70 plates, coloured and plain. Pp. xcix+604 Price 20s. net.

We always look forward to the arrival of a new Medical Annual and this, the forty-ninth volume, is well up to the high standard of former productions. It is a book of some 600 pages, well printed on very good paper. As the Editors explain in their introduction, the function of the Medical Annual is to furnish, year by year, a digest of the world's medical literature, noting especially from the leading medical periodicals, both at home and abroad, new and improved methods of diagnosis and treatment. If the year 1930 cannot point to any outstanding discovery or advance under these two heads, it can at any rate show much of great interest and a good deal that is new. As one turns the pages looking for matter of especial interest to medical officers, one comes to "Food and the Public Health." Here one notes several points: we learn, for instance, that people can be poisoned by eating ducks' eggs. There is a note under "Botulism" which tells us that supplies of botulinus antitoxic serum are kept ready for use at the Ministry of Health and in the public health offices of our larger towns. An increase in the consumption of unpasteurized milk is thought to be the cause of the increasing incidence of the type of undulant fever due to *Bacillus abortus*. Under "Dental Sepsis" a point is made of the possible danger of extracting septic teeth from a patient with damaged heart valves, because this may set up in such people actual ulcerative endocarditis. The treatment of alcoholism and drug addiction is dealt with at some length and opinion seems still divided as to the wisdom of a sudden withdrawal of the particular narcotic which is being taken. Under "Traumatic Neuroses" there is a statement that "the prognosis depends almost entirely on whether the patient is or is not in receipt of compensation," and in proof of this we read that of 23 compensation cases only 4 recovered and these 4 only on receipt of a lump sum payment; while of 17

non-compensated cases 12 recovered. A further note says that "those who are absorbed in their calling but rarely develop functional nervous disorders after trauma." Probably most of us in the Army will agree with this opinion.

Under "Diphtheria" there is an interesting note. The Schick test was performed on 101 East African natives, nearly all children, and not one of them gave a positive result. The antitoxin content of the blood was examined and was found to be high in all of them, fully confirming the Schick test findings. Now diphtheria as a disease is quite unknown in tropical Africa. What is the explanation? This is not an isolated observation because similar results have been reported among Eskimos. The use of insulin, given with the antitoxin, is referred to in the treatment of this disease.

It is reported that anaerobic wound infections, which the World War brought into such prominence, are not so uncommon in civil practice today. The causative organisms are just the same as they were in France, and the use of specific anti-sera is advocated for these infections in addition to the proper surgical treatment. The complement-fixation test has now been shown to be of definite value in the diagnosis of obscure cases of gonorrhœa, and particularly in the case of female patients. A test which was positive and has now become negative is strong and valuable evidence that the disease is cured. Under "Syphilis" some experiments are quoted to test the actual value of prophylaxis with disinfectant ointments. The experiments were carried out on rabbits with calomel cream; the author found that there was no protection if the cream was used more than eight minutes after inoculation with *Sp. pallida.*

One could go on for hours picking out "morsels," but we have now quoted enough to show how full of interest this book is.

We confidently recommend it to all our brother officers.

A. C. H. G.

An Introduction to Medical History and Case Taking. By Geoffrey Bourne, M.D., F.R.C.P. Edinburgh: E. and S. Livingstone. 1931. Pp. xiv + 181. Price 5s. net.

In this little book the author has attained his objective truly and well, for he has not only stressed the importance of obtaining an accurate history from patients, but he has shown the student the way to do it. Moreover, he has converted what is usually considered a dry and dull subject into pleasant reading. . In the various chapters the student who is about to take up the duties of a clinical clerk in the wards will find much valuable help and advice tempered with wisdom and some humour. As he reads he will be taught how to extract a correct history from all kinds of patients and he will learn the main lines of carrying out the physical examination.

When he arrives at the chapter on formulating a diagnosis he will find the descriptive account of a case, the history, and physical examination placed in one column and opposite to each of these its significance in

diagnosis. This chapter is excellent; it illustrates the correct allocation in importance of the points the author wished to bring out in the preceding chapters.

Every clinical clerk should possess a copy of this very useful and handy little book and should use it as a *vade-mecum*.

HANDBOOK OF MILITARY LAW. By Captain R. J. Wilkins, The Sherwood Foresters, and W. S. Chaney, Solicitor (John Mackbell Prizeman). With a foreword by General Sir C. H. Harington, G.B.E., K.C.B., D.S.O., D.C.L. London: William Clowes and Sons, Ltd., 94, Jermyn Street, St. James's, S.W.1. Price 12s. net.

This book was subjected to an unexpected and very practical test two days after it had been received for review.

With the accused trembling on the threshold a question arose as to when a sentry became a policeman and vice versa. The situation was becoming critical when the reviewer bethought him of the volume which he had received two days before. Let it be said at once that it emerged from the ordeal with flying colours and, in half a minute, yielded up the secret which lay buried in the heap of official books which bestrewed the office table. Further tests were applied with equally satisfactory results, and there is no doubt that its usefulness on such occasions will make it an indispensable addition to every adjutant's bookshelf.

Books of this kind often tend to become strings of references acting merely as signposts indicating devious routes through the Manual of Military Law and King's Regulations; the work under review, however, can be relied upon to supply a busy officer with a ruling in a few seconds, while the incredulous will find chapter and verse carefully given for all statements contained in it.

Presidents of courts martial will be especially grateful for the earlier pages where the Form of Proceedings is reproduced *in extenso*, whilst the opposite page carries notes and references which will prove of the greatest value.

For the rest, information from all sources is grouped under appropriate headings, and Sections 4 to 40 of the Army Act are taken seriatim and admirably annotated and referenced.

Those who are facing examinations will find some very useful and practical hints on how to direct their studies, as well as a comprehensive set of questions and answers.

The authors modestly claim that this is primarily a book of reference, but it is a good deal more than that, it is a book that can be read with interest and pleasure in a comfortable chair before the fire.

Some expansion of the Index might perhaps be considered in future editions. For example, the status of members of the Q.A.I.M.N.S. might be included under that heading as well as appearing under "Superior Officers," and no reference can be found to a definition of "Persons Subject to Military Law." It is further suggested that periods of detention awarded

in hours might be added to those given in days, weeks, and months on p. 138. These are, however, minor points which in no way detract from the value of a book which is destined to become an ever present help to every officer, whether he be the President of a general court martial or a subaltern up for his promotion examination.

The publishers are to be congratulated upon producing a most attractive volume which it is a pleasure to handle.

Notices.

TWO-PIECE ALL GLASS SYRINGES.

MESSRS. BURROUGHS WELLCOME AND CO. have issued two-piece all glass syringes in spirit containers so that a syringe and rustless needle can be carried ready for use.

The syringe is placed in a glass tube filled with spirit, the top of the plunger fitting the glass tube as a stopper.

The syringe and tube can be carried in a metal case, the lid of which closes the glass tube when the syringe is removed, so preventing loss of spirit.

The tips of the syringe plungers are coloured blue, which makes it easy to read the amount of fluid in a syringe.

The sizes of the syringes are:—

One cubic centimetre "Agla" two-piece syringe (also graduated in minims).

One cubic centimetre "Agla" two-piece insulin syringe (graduated in $\frac{1}{20}$ of 1 cubic centimetre).

Five cubic centimetres "Agla" two-piece syringe.

Ten cubic centimetres "Agla" two-piece syringe.

CATALOGUE OF MESSRS. BAILLIÈRE, TINDALL AND COX.

MESSRS. BAILLIÈRE, TINDALL AND COX published in June, 1931, a catalogue of their medical, veterinary and scientific publications.

The medical, dental and nursing section, in forty-three pages, covers all branches of medical work.

There is a useful index of authors and of subjects.

BRITISH RED CROSS SOCIETY LECTURES.

THE British Red Cross Society will hold a course of nine lectures and demonstrations on Tropical Hygiene and Nursing, commencing on Monday, September 28, at 5.30 p.m. This course should prove of great interest to persons who are going to warm climates for the first time. Particulars may be obtained from the County Secretary, 9, Chesham Street, Belgrave Square, S.W. 1.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C. 2.

VOL. LVII. SEPTEMBER 1931. No. 3.

Journal

of the

Royal Army Medical Corps.

Original Communications.

SOME INVESTIGATIONS INTO SO-CALLED "NON-AGGLUTINABLE" DYSENTERY BACILLI.

BY MAJOR J. S. K. BOYD,
Royal Army Medical Corps.

IN the routine examination of stools from cases of bacillary dysentery (a disease which can readily be diagnosed from the clinical features of the case combined with the microscopic examination of the mucous exudate), it is a common experience to isolate organisms which, in their morphological, cultural and biochemical characters are identical with the classical strains of dysentery bacilli, but which are not agglutinated by the appropriate high titre sera. Although it is the practice in the Army in India to return these as "dysentery bacilli, non-agglutinable," the compromise has several undesirable features, and the present investigation is an attempt to classify at least a proportion of these serological outcasts.

CLASSIFICATION OF DYSENTERY BACILLI.

To define the exact scope of this inquiry, a brief descriptive classification of dysentery bacilli may be given.

(*a*) *Morphological Characters.*—Dysentery bacilli are all non-motile, non-sporing, non-capsulate, Gram-negative bacilli.[1] They can be grown on all ordinary media, and are readily maintained in artificial culture over prolonged periods.

[1] *B. morgan*, which is motile, is not considered to be a cause of tropical bacillary dysentery.

(*b*) *Biochemical Characters.*—A comparatively comprehensive classification can be effected by means of their biochemical reactions, particularly the fermentation of certain carbohydrates and the production of indol from peptone.

Lactose.—All dysentery bacilli are alike in failing to ferment lactose in the early days of their culture, although one group is found to produce acid after some days of incubation.

Glucose.—All ferment glucose, with acid production.

Mannite.—The reaction of this "sugar" differentiates the two chief groups. The "Flexner" and "Sonne" groups produce acid, while *B. dysenteriæ* Shiga and *B. dysenteriæ* Schmitz do not.

Dulcite.—According to the classification now in vogue, dysentery bacilli do not ferment dulcite. It will be found, however, that one of the organisms about to be described is a late dulcite fermenter.

Maltose.—The action on maltose is so uncertain as to be valueless. In this investigation it was tried out in a large number of cases and found of no help.

Saccharose.—Differences of opinion exist as to the action of Flexner bacilli on saccharose. The most carefully recorded results are those of Gettings [1]. Of 285 strains tested, one gave acid, another slight acid, and the remainder produced no change in saccharose. The writer has had similar positive results in rare cases, usually occurring in the third week of incubation. Whenever such results occurred, fresh inoculations in saccharose have been put up. On no occasion was the result confirmed. It has been concluded, therefore, that the first result was due, most probably, to some contamination either chemical or bacterial. It is believed that impurity of the reagent accounts for the majority of anomalous results. Non-fermentation of saccharose is therefore regarded as an essential characteristic of true Flexner bacilli.

Of the bacilli which produce acid in glucose and mannite, a certain number will be found to produce acid in saccharose, generally after a few days' incubation. The majority of these organisms will also be found to be late fermenters of lactose. This is regarded as a definite group, a member of which is *B. dysenteriæ* Sonne. There are, however, many others which are serologically distinct from Sonne. These are commonly encountered in stools from non-dysenteric cases, and it is doubtful if many have any pathogenic action. Their importance from the point of view of the present investigation lies in the fact that they comprise a considerable proportion of the strains loosely labelled "non-agglutinable Flexner," simply because the saccharose tube is not incubated for a sufficiently long time to detect the fermentation.

There remains the large and important group of mannite fermenting, non-saccharose fermenting organisms, which includes those named *B. dysenteriæ* Flexner. They are in India the most common cause of bacillary dysentery. It is in this group that the greatest difficulty as

regards agglutination is encountered, and it is with these non-agglutinable strains that this work is concerned.

Table I gives the above classification in graphic form.

TABLE I.

Non- or late lactose fermenting coliform bacilli.

- Motile or gas-producing in glucose. Enterica, salmonella, &c.
- Non-motile, acid, without gas in glucose
  - Mannite fermenting
    - Saccharose acid. *B. dysenteriæ* Sonne. *B. dispar*. *B. metadysentery*, &c.
    - Saccharose not acid
      - *B. dysenteriæ* Flexner
      - Organisms with these sugar reactions, but not agglutinated with Flexner serum
  - Non-mannite fermenting *B. dysenteriæ* Shiga, *B. dysenteriæ*. Schmitz, &c.

PREVIOUS SEROLOGICAL CLASSIFICATION OF DYSENTERY BACILLI.

The problem of non-agglutinable Flexners is no new one. During the war they were constantly being encountered, and much diversity of opinion existed as to the validity of various strains. To clarify matters, Sir F. Andrewes, [2] under the auspices of the Medical Research Council, collected a series of cultures which he made representative as far as possible, and proceeded to elaborate the now accepted classification of V, W, X, Y, Z, VZ and WX.

In passing, it might be of value to state one's experience in typing all strains of Flexner which have come to hand in the course of two years. All Andrewes' types have been encountered from time to time. In addition to these recognized types, strains embodying almost every possible variation of antigenic complex have also been encountered. From the statements in a recent article in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS [5] one is rather led to think that there need never be any difficulty in placing an organism in one or other of the above types. This is definitely not the writer's experience, nor has it been that of several others who have written on the subject [4 and 6]. Not only do variations occur from case to case, but if several colonies be picked off the same plate, and carefully put up against identical sera, remarkable variations in antigenic structure will sometimes be revealed. From the practical point of view, this is of no importance. A good polyvalent serum will bring them all down, and there need never be any doubt about an organism which satisfies this test. It can be placed definitely in the Flexner group.

It must be noted that of the strains used by Andrewes in his investigations, only one came from India. Now in 1929, in the military laboratories

of India, 894 organisms giving Flexner biochemical reactions were isolated from cases of clinical dysentery. Of these, 282, or 31·5 per cent. did not agglutinate with standard serum. It seems only reasonable to assume, therefore, that the series from which Andrewes' classification was built up was not sufficiently exhaustive, and that other serological strains are entitled to consideration as being potential causes of dysentery.

In order to select those most likely to repay further investigation, advantage has been taken of the well-known fact that the occurrence of dysentery bacilli in the stools of cases follows a very definite course. If a perfectly fresh piece of mucus from an early case be plated, numerous colonies of the pathogenic type will be encountered. As the case progresses, and macrophages come to replace the polymorphs in the mucus exudate, the organism is then much more difficult to recover. Finally, when on careful examination of the stool of the convalescent no mucus can be found, it will be seen on culture that the organism has also disappeared.

Where an organism, biochemically Flexner but non-agglutinable, presented such an incidence in the course of a case of bacillary dysentery, the strain was earmarked for further investigation.

Similarly, the agglutinating powers of these organisms were tested against very high titre Flexner sera, so that a relatively small proportion of heterologous agglutination could be detected. Such heterologous agglutination was encountered in certain strains, and these were also regarded with suspicion.

Homologous sera were prepared for certain strains selected in these ways, cross-agglutination and absorption tests were performed, and by these means definite types were identified and rendered identifiable.

In order to allow others to test the validity of these findings, it is proposed to describe without further preamble three strains determined in this way which embrace the majority of non-agglutinables occurring in Southern India.

Each of these strains will be given its laboratory index number.

While these organisms were being collected and investigated from cases of dysentery, other work of a routine nature, which constitutes a very interesting and important control, has been carried out in the laboratory. An extensive examination of so-called food-handlers has been in progress. In the course of two years the writer has examined just over 2,000 of these, with a total of between 5,000 and 6,000 platings of fæces. In the majority of these cases the platings were carried out under circumstances ideal for the recovery of any delicate organisms present. The cooks, water-carriers, waiters, bakers, dairymen, etc., were caused to swallow a dose of salts at an unearthly hour in the morning, then made to parade and produce a specimen at the laboratory, which had a special latrine and pans for the purpose. The stools were plated within a few minutes of being passed, the same medium being used that was employed

for the investigation of the dysentery cases. On no single occasion has an 88 (one of the two strains about to be described) been recovered from these individuals.

STRAIN NO. 88.

This has been isolated as follows: Bangalore, 1929, 8 times; Bangalore, 1930 and 1931, 8 times; Secunderabad, 1928, 1929, 5 times (a collection of 35 strains from this laboratory was kindly given to me by Major W. Walker); Poona, 1931, once.

All cases from which the organism was recovered presented symptoms of dysentery. Clinically, the type of case has been similar to the average infection with Flexner. The following may be taken as a typical case:—

Lieutenant McK., I.M.S.

April 21, 1930.—The illness started suddenly shortly before midnight, with violent diarrhœa accompanied by colic and tenesmus. The patient felt distinctly ill, and found his temperature to be 102·3° F.

April 22.—Twenty stools in the day. About the twelfth stool blood and mucus appeared. This persisted for a few stools, and then gradually disappeared. It should be noted, however, that the patient made what proved to be a correct diagnosis of his condition shortly after its onset and started vigorous saline treatment. Considerable colic and tenesmus persisted throughout the day. A specimen was brought to the laboratory about midday, and was less than five minutes old when received and plated. The mucus showed a typical bacillary exudate. The plate gave an almost pure culture of 88.

April 23.—Eight stools, watery. No very obvious mucus (report by patient's wife). Still on saline. Morning temperature 99·6° F., evening temperature 99° F. No stools during night of 23rd to 24th.

April 24.—Two stools, watery. One sent to the laboratory. Slight flakes of mucus still present. Microscopically still cellular. Organism again recovered on culture (two colonies on the plate). Temperature normal. Much more comfortable.

Thereafter the stools became more solid (saline treatment being gradually omitted), and the patient went on sick leave, ten days from the onset, feeling and looking distinctly below normal.

Biochemical reactions of 88.—Lactose, no change. Glucose, acid. Mannite, acid. Dulcite acid (late and inconstant); 50 per cent three to four days; 33 per cent twenty-seven to twenty-eight days; 16 per cent unchanged after six weeks. Saccharose, no change. Milk, acid at first, neutral four to seven days, alkaline (majority very faint) eleven to sixteen days. Indol, negative.

It will be noted that a distinctive factor exists, namely, the fermentation of dulcite by approximately five-sixths of the strains. This point will receive further consideration at a later stage.

Serological Reactions.—(*a*) In relation to high titre diagnostic sera.

This strain is a distinct and constant serological entity. It is practically inagglutinable with V, W, X, Y and Z sera, the sole exception being W, with which some strains will agglutinate up to five per cent of titre of the serum.

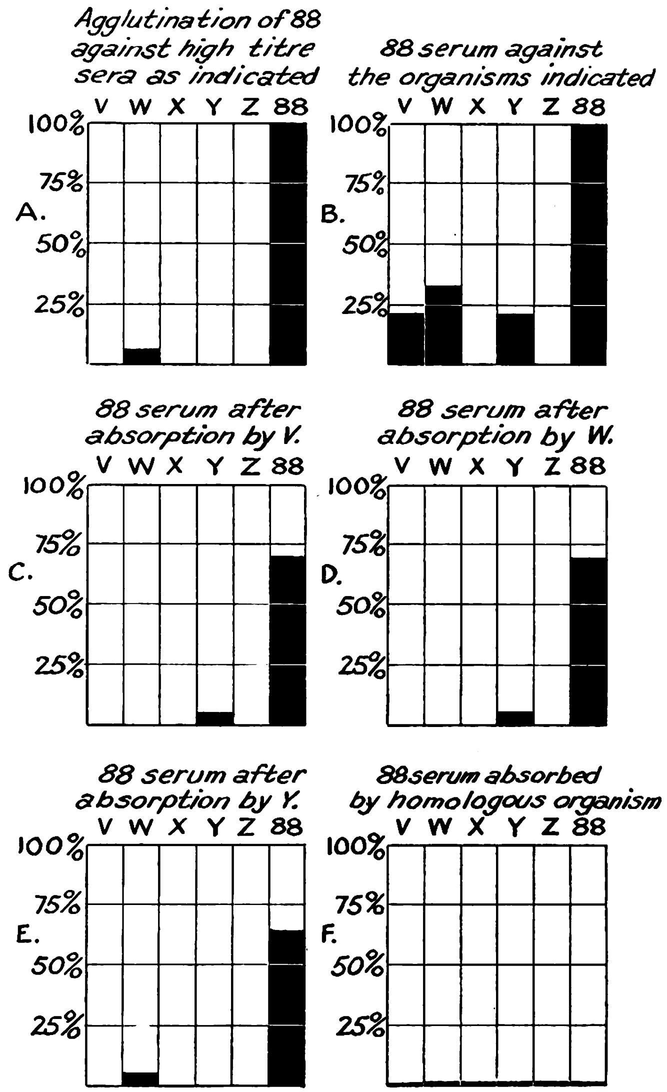


FIG. 1.

The agglutinogenetic properties of the organism are moderate, and a serum with a titre of from 1,000 to 2,500 can be produced fairly easily. All strains agglutinate to titre with such a serum. An interesting point is

that this serum contains a fair proportion of heterologous agglutinins for V, W, and Y. The accompanying histograms (fig. 1), showing the agglutinin content of a serum prepared from 88, illustrate this point clearly. Sera from other strains have been prepared, and differ from this one only in showing minor variations in heterologous agglutinins.

(*b*) In relation to the serum of cases of dysentery.

The negative evidence may first be stated. In thirty-three cases of infection with "classical" Flexner bacilli, samples of serum taken at varying stages of the illness (two from each case) were tested against an emulsion of 88. Of these, thirty-one were completely negative, and two showed slight agglutination in a dilution of 1 in 25.

Conversely, with one exception, agglutinins for 88 have been found in all cases of infection with this strain, which it has been possible to test.

The following Tables (II, III, IV and V) show the agglutination and absorption results in four cases. They are self-explanatory, and furnish considerable evidence of the pathogenicity of the strain :—

TABLE II.

Lieutenant McK. (case described above).

	V	W	X	Y	Z	88	Hom.
Serum (7th day)	25	125	—	50	—	25	—
Serum (abs. hom.)	—	—	—	—	—	—	—

TABLE III.

Serjeant B.

	V	W	X	Y	Z	88	Hom.	Sh.
Patient's serum, 8th day..	25	10	—	35	—	30	40	—
15th day..	20	—	—	35	—	—	25	—

TABLE IV.

Private H.

	V	W	X	Y	Z	88	Hom.	Sh.
Patient's serum, 11th day	25	35	—	25	25	175	—	—
17th day	50	100	—	25	—	250	25	—
,, (abs. W.) ..	—	—	—	—	—	250	—	—
,, (abs. hom.)..	—	—	—	—	—	—	—	—

Table V.

Private R.

	V	W	X	Y	Z	88	Hom.	Sh.
Patient's serum 6th day	50	250	—	25	—	—	—	—
15th day	50	150	—	25	15	250	—	—
19th day	50	—	—	—	—	250	—	—
,, (abs. W) ..	—	—	—	—	—	100	—	—
,, (abs. 88) ..	—	—	—	—	—	—	—	—

Abs. = absorbed. Sh. = Shiga. Hom. = homologous. The emulsion of "88" used in these tests was prepared in the same way as standard agglutinable emulsions of the other dysentery organisms. The same batch was used throughout, and for the control tests mentioned above.

Relationship to B. alkalescens (*Andrewes*).—The fact of the organism being a dulcite fermenter immediately raises the question of its relationship to *B. alkalescens* (Andrewes), which also possesses this property [7]. Table VI shows the biochemical reactions of the two organisms.

Table VI.

	Alkalescens	88
Lactose ..	*Nil*	*Nil*
Glucose ..	Acid	Acid
Mannite ..	Acid	Acid
Dulcite ..	Acid 24 to 48 hours	Acid 3rd to 31st day, if at all
Milk ..	Alkaline 3rd day	Acid at first Neutral 4th to 7th day Alkaline (faint) 11th to 16th day
Indol ..	Positive	Negative

A subculture of *B. alkalescens* (Andrewes' own strain) was obtained from the National Collection of Type Cultures at the Lister Institute. It gave exactly the biochemical reactions which are shown above, but, more important still, it failed completely to agglutinate with 88 serum.

88 is, therefore, an entirely separate strain from *alkalescens*. It is to be recognized by the more delayed fermentation of dulcite, by the absence of marked alkali formation in milk (the feature which gained for *alkalescens* its specific name), by the absence of indol formation, and, most important of all, by its different antigenic complex.

It may be said, in further evidence, that true *alkalescens* of Andrewes type has been isolated here on two occasions from the stools of cases which presented no symptoms of dysentery.

Summary and Conclusions.—88 occurs in relation to cases of bacillary dysentery in the same way as do the accepted dysentery bacilli, i.e., it can readily be recovered in the early stages, and rapidly disappears when convalescence sets in. It has never been found in cases of bacillary dysentery

in conjunction with accepted Flexner bacilli. It has never been recovered in the examination of over 2,000 non-dysenteric cases.

In its principal biochemical reactions it resembles the Flexner bacillus. It differs in being an inconstant late dulcite fermenter.

Serologically, it is a sharply defined entity. While itself unaffected by Flexner sera, with the exception of slight reaction to W, it produces a serum showing a fair proportion of heterologous agglutinins to V, W, and Y.

The sera of patients infected with 88 show, particularly about the third week, appreciable agglutinins for this organism. Such agglutinins are lacking in sera from cases of infection with the accepted Flexners.

88 differs from *B. alkalescens* (Andrewes) in the following points:—

(*a*) Dulcite fermentation, if present, is much delayed.

(*b*) There is no marked alkali formation in milk.

(*c*) Indol is never formed (always in *alkalescens* according to Andrewes).

(*d*) The antigenic complex is quite different.

Strain No. 103.

This strain has been encountered as follows:—

Bangalore, 1929, 5 times; Bangalore, 1930 and 1931, 5 times; Secunderabad, 1928 and 1929, 3 times; Poona, November, 1930 to February, 1931, 4 times; Mhow, 1931, once.

Like 88, it has only been isolated from cases presenting symptoms of bacillary dysentery. These symptoms have been mild to moderately severe, and require no special comment. The organism in its incidence presented the features previously detailed. It has frequently been isolated on successive days from the same case. One case after a fortnight's apparent convalescence relapsed, diarrhœa with blood and mucus in the stools reappearing. The organism, which had been absent on two occasions in normal looking stools in the convalescent interval, was again recovered in considerable numbers from the blood and mucus during the relapse.

No other dysentery organisms have been found in these cases. Neither has 103 ever been found in the 2,000 odd normal individuals who constitute the control.

Biochemical Reactions.—Lactose, no change; glucose, acid; mannite, acid; dulcite, no change; saccharose, no change; milk, acid, late neutral or faint alkaline; indol, may or may not be formed. 103 thus agrees exactly in its biochemical reactions with the classical Flexners.

Serological Reactions.—(*a*) In relation to high titre sera.

Using sera with a titre of 1 in 250, this organism will frequently show agglutination in 1 in 25 against X and Y, more rarely against V and W, but so far never against Z. Quite commonly, however, no such agglutinations occur. The slight degree of agglutination has, in fact, been found to vary from day to day in a way that is difficult to explain.

Occasionally trouble is experienced through the fact that immediately

on isolation certain strains are somewhat glutinous and difficult to emulsify. This property usually disappears after a few subcultures. The difficulty can be overcome by emulsifying the growth from an agar slope with ten per cent saline and then adding ten times the bulk of distilled water. The culture washes off into the strong saline in heavy flakes, but as soon as the distilled water is added these flakes disperse in a remarkable fashion and a perfect emulsion results. Emulsions sometimes show a slight auto-agglutination on standing; for example, a little white curd can usually be stirred up from the bottom of the control tube in an agglutination test when it has been left to stand overnight.

The properties of the homologous serum will be more conveniently described at a later point.

(*b*) In relation to the patient's serum.

This part of the investigation has up to date been unsatisfactory. For a variety of reasons it has been possible to test the serum of only three cases. None have shown any agglutinins for 103 as isolated; somewhat significant results were, however, got in one case (see Table VIII). It will be noted that a rise of agglutinins for V and W occurred, and that all agglutinins were removed by absorption with 103.

Development of an Agglutinable Variant.—By far the most interesting character of this organism remains to be detailed.

Various workers [8] have from time to time described the occurrence of a Flexner bacillus, non-agglutinable when isolated, which after a period of culture on artificial media became agglutinable with Flexner sera.

Several explanations of this phenomenon have been offered. In general it seems to have been assumed to be a property acquired at random by one or other of the classical strains which, owing to some unexplained conditions (the medium used for isolation has frequently been blamed), loses the property of agglutination, but re-acquires it after repeated subcultures, particularly in broth.

Others suggest that the agglutinability is associated with the mutation of "smooth" to "rough." To make this clear, it will be necessary to detail briefly the current doctrines regarding this change in the dysentery organisms.

On isolation, all members of the Flexner group are "smooth" (S). By smoothness is meant that colonies on a plate of solid medium have a regular outline, are devoid of any grain or texture, emulsify readily in normal saline without auto-agglutination, and grow as a generalized turbidity in broth. After subculture on artificial media over periods which vary in different cases, certain colonies of a different type appear when the organism is plated. These are irregular in outline and contour, have distinct grain or texture, auto-agglutinate when emulsified in normal saline, and grow in broth as a deposit. Such colonies have been termed "rough" (R).

R colonies are believed to represent a degeneration on the part of the

organism. This, when it has taken place, is, as far as *in vitro* culture goes, to all intents irreversible, i.e., rough variants, once isolated, breed true indefinitely. From the S form both S and R colonies may be produced.

As a rule, the two types, when growing side by side on a plate, show an appreciable difference in size, R tending to be from two to three times the size of S.

The essential difference between S and R, however, lies not so much in their physical characters as in antigenic composition. Whereas smooth V, W, X, Y and Z can be differentiated by an agglutination test using monospecific sera, rough V, W, X, Y and Z cannot be so separated. They are, in fact, identical. A serum prepared for rough Z will agglutinate rough V, W, X and Y to the same degree as rough Z. In other words, the antigen of the R variant is common to the whole group. Further, S sera have no action on any R organism, and vice versa, the common R serum will not agglutinate any S strain.

Though in the transition stage gradations between S and R may, and do, occur, the change of antigen as between true S and true R is absolute.

It has been suggested that late developed agglutinability in Flexner-like organisms is due to (*a*) the development of roughness in the strain, and (*b*) the use of high titre serum prepared from a strain which had gone partially rough. Interaction between the R elements is supposed to occur. This, however, is not the explanation. In fact, as far as Flexner bacilli are concerned, the fear of "roughness" in the serum is rather a bogey. The production of a high titre serum for a known R strain is a very difficult matter, and the casual presence of a few degrees of roughness in an emulsion used for making a smooth serum would have little or no effect.

The explanation of the phenomenon does, however, lie in mutation, but in mutation of a type which as far as the writer is aware has never previously been described.

In the first place, it has been found that the property of late developed agglutinability belongs to one specific strain, viz., the one described above as 103. Of the eighteen strains of this organism isolated, fifteen have already developed agglutinability. Conversely, of thirty-three other strains which were not agglutinable on isolation, or when first tested with V, W, X, Y, Z, or 103 serum, and which have been under observation for varying periods, some as long as two years, none has ever become agglutinable.

The principles involved in this mutation are so much at variance with accepted ideas that the matter must be discussed in detail. A description of the investigations and findings in connection with 103 is probably the simplest way of approaching the subject.

History of 103.—103 was isolated on June 16, 1929, from the stool of an officer suffering from typical clinical bacillary dysentery. The biochemical reactions of the organism were as given above.

On June 19, 1929, a broth-culture failed to agglutinate with polyvalent Flexner serum.

On July 18, 1929, a broth-culture agglutinated to a titre of 1 in 50 with polyvalent Flexner serum (about five per cent).

On August 7, 1929, a broth-culture agglutinated to a high titre with V, W, X, Y, and Z serum, but the agglutination was only a partial one, i.e., the emulsion was not completely cleared. End points were in consequence very difficult to read.

On August 17, 1929, the test was repeated, using emulsions washed off agar slopes with saline. Similar results were obtained. The lack of clearing was so marked that contamination was suspected, and plates were made of some of the unused emulsion.

On August 18, 1930, the plates showed two very distinct types of colony, whose characters will be given in tabular form later. Both types proved to have the correct Flexner biochemical reactions; one was, as before, non-agglutinable with Flexner serum, while the other agglutinated with V, W, X, Y, and Z serum.

The experiment of plating from the original stock strain was tried several times, and with more or less difficulty the two types of colony could always be obtained. As time went on the proportion of agglutinable colonies increased at the expense of the others, and from July, 1930, repeated attempts to isolate a non-agglutinable colony from this strain have been unsuccessful.

The physical characters of the two types of colony, as occurring in strain 103, are as follows :—

A. The original colony.	B. The variant.
(1) Small lenticular colonies, regular in outline and texture.	Large, more or less straggling colonies of irregular outline and contour, and showing a grain or texture. When growing side by side on the same plate, these colonies are about three times the size of the A type.
(2) Emulsifies as a rule readily in 0·9 per cent saline, but occasionally does not emulsify well. Sometimes there is a slight tendency towards auto-agglutination, but this is never complete.	Emulsifies readily, and has no tendency to auto-agglutinate.
(3) Grows with generalized turbidity in broth.	Grows with generalized turbidity in broth.
(4) Produces both A and B type colonies, unless an A colony is carefully selected and regularly subcultured each day.	Has bred true, producing nothing but B colonies, from the day of isolation over eighteen months ago.
(5) Non-agglutinable with Flexner sera.	Readily agglutinable with Flexner sera.

A consideration of these points will show considerable resemblance to, and some variation from, the S and R variants of the orthodox Flexner strains. In points 1, 3 and 4, A resembles S, while in points 1 and 4,

B resembles R. Variation occurs in points 2 and 5 in A, and points 2, 3 and 5 in B.

An attempt was made to test the agglutinins in the patient's serum against the A and B variants, and approximately ten weeks after recovery serum was obtained, and gave the following results :—

TABLE VII.

V	W	X	Y	Z	103 B	103 A
1/250	1/250	*Nil*	1/125	*Nil*	1/350	*Nil*

From this it appears that at this interval (ten weeks) the patient's serum contained no agglutinins for the A form which was the type isolated. Conversely the B variant is agglutinated to quite a high titre.

To study the antigenic characters of these variants emulsions were prepared and rabbits immunized. In this connection it may be said that although every effort was made, it is not considered that from this particular strain a pure A emulsion was ever obtained. Production of B variants in A cultures was occurring freely, and the agglutination results confirm the fact that B (whose agglutinogenetic properties proved to be much greater than those of A) was never successfully excluded. Hereafter the variants will be referred to as 103A and 103B.

103A.

The results of cross agglutination and absorption tests are shown in fig. 2. As has been previously noted, this strain has not been agglutinated by V, W, X, Y and Z smooth sera nor by a "rough" Flexner serum. It is very slightly agglutinated by a high titre of 103B serum. 103A serum, however, contains considerable co-agglutinins for V, W, X, Y and Z, and particularly for 103B. This latter is no doubt due to the fact that, as explained above, B variants were not excluded from the emulsion used to immunize the rabbit. Absorption results confirm the nature of the co-agglutinins.

This strain has only moderate agglutinogenetic properties, but a serum with a titre of 1 in 1,000 was obtained on two occasions without much difficulty.

103B.

Here again the results are most clearly expressed by diagrams (fig. 3).

It will be noted in the first place that 103B bears little if any relationship to "rough" Flexner, being agglutinated only to 2·5 per cent of the titre of the serum used in these experiments, while 103B fails entirely to agglutinate "rough" Flexner.

Conversely 103B is agglutinated to titre (actually it was slightly beyond titre) by W, X and Y, and to a relatively high titre by V and Z. It is further agglutinated by 103A serum to about three times the titre of that

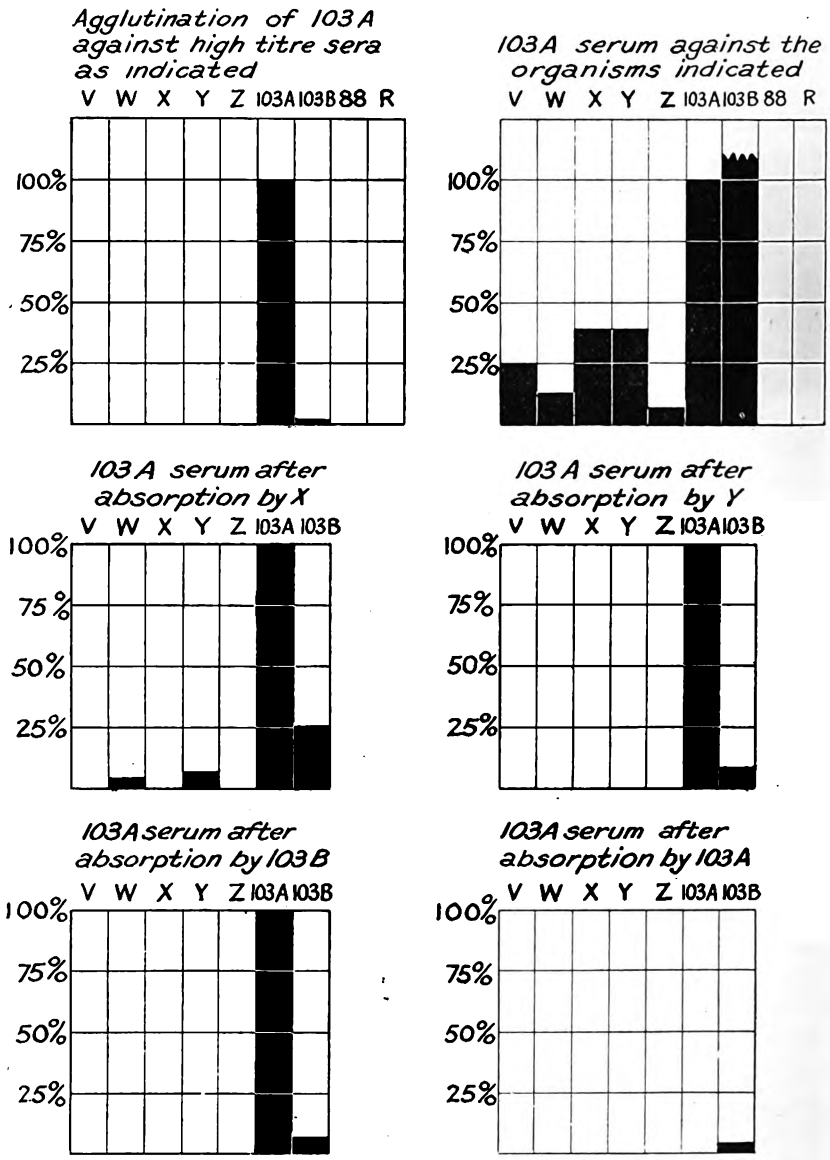


Fig. 2.

serum for its homologous organism. The explanation of this has already been offered.

103B has marked agglutinogenetic properties, and a serum with a titre

of 1 in 10,000 to 1 in 20,000 can readily be produced. It will be noted that this serum contains heterologous agglutinins for smooth V, W, X, Y and Z, and also to a small extent for 103A. Absorption tests are particularly

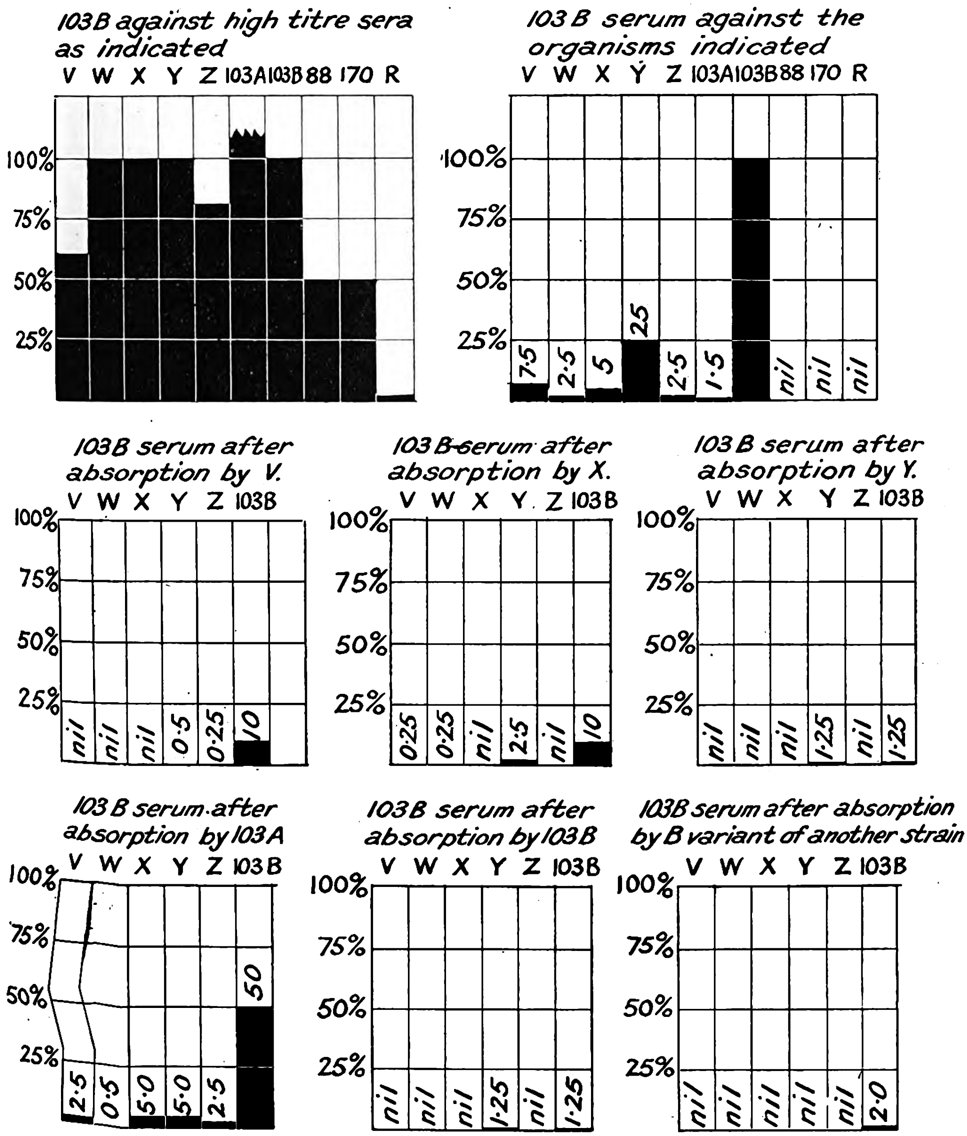


Fig. 3.

illuminating. They indicate a close relationship to all the classical Flexner strains, but particularly to Y.

What is the explanation of these apparently anomalous findings? It would clearly appear to be as follows.

When originally isolated the strain was pure A with no B in its composition, hence its non-agglutinability at that time and a month later. 103A is in fact a serological entity which is practically inagglutinable with V, W, X, Y and Z serum, although capable of producing a serum with heterologous agglutinins for these strains. Subsequently B variants were produced and came to dominate the cultures. This B variant, in contrast to the R variant of the classical Flexners, is readily agglutinated by all smooth Flexner sera. Its antigenic composition seems almost identical to Y, from which it differs only in being much more sensitive to agglutination.

Briefly, this strain in its original phase is a separate entity ; the variant which develops contains an antigen embodying all those found in the smooth strains of V, W, X, Y and Z.

Identification of Further Strains.

Using 103 serum as a test, a search was made among previously isolated inagglutinable Flexners for further strains of this organism. This met with immediate success.

Already in the laboratory there were two strains, inagglutinable when isolated by a predecessor, which had become highly agglutinable. These proved to be pure type B, and were agglutinated to full titre with that serum. (N.B.—As shown in figure 3, V, W, X, Y and Z agglutinate to only a low percentage of the titre of this serum.)

Four other inagglutinable strains proved to be similar to 103A. These were plated, and on one plate (from strain D35) a single B type colony was seen. This when subcultured proved highly agglutinable, and in fact was an exact replica of 103B. Greater difficulty was experienced with the other strains, but with one exception they have now all produced B variants.

Since the identification of 103, eleven newly isolated strains have come to hand, nine isolated in the writer's laboratory, and two sent from other laboratories in the Command. Of these eleven, nine have produced agglutinable variants of the B type.

The agglutinable variants have always been true to type as far as agglutinability is concerned, but in some cases the naked eye differences between A and B colonies have been much less marked than was the case with 103. Viewing the plate against the dark background of the "comparator" used for reading agglutination tests often proved helpful. A colonies appeared white and somewhat opaque, while B colonies were more clear and translucent. This character was also inconstant, and in one case there were no appreciable differences in the physical characters of the colonies, which were selected more or less at random, and proved by agglutination.

At the risk of being tedious, a few case histories are given in illustration of the way in which this mutation occurs.

STRAIN No. B 172.

Patient was admitted with a history of one day's diarrhœa with blood and mucus.

July 9, 1930. Specimen sent to the laboratory was a liquid stool containing blood and mucus. Microscopically bacillary exudate.

July 10. Two colonies taken from the plate made yesterday, which contained numerous other similar ones. Both gave the biochemical and serological reactions of 103.

Patient still has diarrhœa with colic and tenesmus. Microscopically bacillary exudate.

July 11. The same organism isolated from yesterday's plate.

Serological Findings.—The following table (Table VIII) shows the agglutinins present in the patient's serum, and the effect of various high titre sera on the strain as isolated. This strain was at first a very difficult one to emulsify.

TABLE VIII.

	V	W	X	Y	Z	SS	Sh.	Hom.
Patient's serum, 14th day	25	—	—	—	50	—	—	—
19th day	50	125	—	—	50	—	—	—
,, (abs. hom.) ..	—	—	—	—	—	—	—	—
	V	W	X	Y	Z	103A		
Agglutination percentage of organism on isolation	—	—	10 %	10 %	—	100 %		

July 13. Strain cultured in broth to which a drop of 103 serum had been added.

July 14. Broth-culture plated.

July 15. All colonies alike. Replate.

July 16. Slight variation in size of the colonies. No apparent roughness. One large colony subcultured and gave the following agglutination :—

TABLE IX.

V	W	X	Y	Z
Per cent 50	Per cent 50	Per cent 20	Per cent 100	Per cent 20

July 17. No further specimens received till to-day, when a normal stool containing no blood and mucus was submitted. Culturally negative. Specimens received daily with similar findings till July 20.

July 18.—Further plate of the same serum broth-culture shows no variants which physically resemble 103B. One large colony selected, subcultured and agglutinated in parallel with a subculture of the strain as isolated as control; results shown in Table X.

TABLE X.

	V	W	X	Y	Z
	Per cent	Per cent	Per cent	Per cent	Per cent
Original	—	—	20	20	—
"Serumed" colony.. ..	50	50	20	100	20

July 21. The above test repeated, using fresh cultures of the same strains. Identical results were obtained.

August 6. Repeated attempts have been made, by plating from old broth-cultures, old agar cultures, &c., to get an agglutinable variant from the original strain without the intervention of serum broth. All have failed. A fresh serum broth-culture has been made from which was subcultured a colony giving the following results, shown in parallel with a colony from an "unserumed" source:—

TABLE XI.

	V	W	X	Y	Z
	Per cent	Per cent	Per cent	Per cent	Per cent
Original	10	—	20	14	—
"Serumed" colony.. ..	80	100	14	100	10

The two strains giving these results have been plated, each on a half of an agar plate. In appearance the colonies could not be distinguished. As a control a colony was selected at random from each half of the plate and agglutinated against Y serum. The "original" colony gave no agglutination, and the "serumed" went to titre.

Conclusion.—This strain as isolated corresponds to 103A. In straightforward culture it has retained its characteristics.

By culturing in the presence of 103A serum a variant having the serological characters of 103B has been produced.

Unlike the state of affairs with 103, it is impossible to distinguish the variants by colony characters.

STRAIN NO. B 215.

August 27, 1930. Patient complained of diarrhœa with blood and mucus of one day's duration. Specimen sent to the laboratory consisted of blood and mucus only. Microscopically bacillary exudate.

August 28. A strain proving to be similar to 103, readily isolated (*a*). Specimen received again blood and mucus only. Bacillary exudate.

August 29. A similar organism isolated (*b*). Stools still show blood and mucus and bacillary exudate.

August 30. Specimen sent was a watery stool with traces of blood and mucus.

August 31. Watery stool with a little non-cellular mucus. Plate negative.

September 1. Watery stool, no blood and mucus. Plate negative.

September 3 to 9. Formed stools. A little adherent mucus on two occasions. Plates negative.

Agglutination Results of Isolation are shown in Table XII.

TABLE XII.

		V	W	X	Y	Z	103A	103B
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
30.8.30.	Colony (a)	30	5	30	20	—	100	5
5.9 30.	Colony (a)	—	—	6	6	—	30	—
5.9.30.	Colony (b)	—	—	6	6	—	30	—
8.9.30.	Colony (b)	—	—	—	—	—	100	—

The variations in agglutinability commonly encountered in this series are seen here.

As isolated, the strain was very difficult to emulsify, and 0·2 per cent saline had to be used. This characteristic was lost after a few subcultures.

September 7. Inoculated in broth to which some sterile filtrate of a broth-culture of 103B had been added.

September 8. Plated.

September 9. Colonies doubtful. One subcultured and agglutinates as follows :—

V	W	X	Y	Z	103A
					Per cent
—	—	—	—	—	50

September 11. Subcultured in broth containing a drop of 103A serum.

September 12. Plated.

September 13. Some colonies on the plate have the physical characters of 103B. One of these subcultured agglutinates as follows :—

TABLE XIII.

	V	W	X	Y	Z	103A
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
"Serumed" colony	100	100	100	100	100	100
Original. 16.9.30	—	—	10	10	—	100

September 16. The original strain was subcultured to ascertain if B elements were appearing in the normal course of events (see Table XIII).

Conclusion.—The agglutinable variants seem to have appeared by virtue of culture in the presence of 103A serum. No such variants are present in stock strains.

STRAIN No. P 8.

October 28. Patient admitted to hospital complaining of diarrhœa with blood and mucus in stools. Much griping. Temperature found to be 99·6° F. The specimen sent to the laboratory consisted of blood and mucus, was alkaline in reaction, and microscopically showed bacillary exudate. Three colonies, proving to be 103, isolated.

October 29. Specimen still bacillary exudate.

October 30. Still bacillary exudate. The same organism again isolated.

October 31. Watery stool. No blood and mucus. Plate negative.

November 1. No blood and mucus. Culturally negative.

The colonies isolated on October 28 and 30 gave the following results :—

TABLE XIV.

	V	W	X	Y	Z	103A	103B
						Per cent	
Colony of 28.10.30 ..	—	—	—	—	—	50	
Colony of 30.10.30 ..	—	—	—	—	—	50	

November 7. Inoculated in broth and broth plus 103A serum.

November 10. Plated from broth. No success.

November 19. A further set of plain and serumed broth-cultures put up.

November 26. Plated. Variations in size of colony present, but not suggestive of mutation. Following results obtained :—

TABLE XV.

	103A	103B
	Per cent	Per cent
Small colonies	66	2
Large colonies	100	5

December 10. Plated from plain and serum broth cultures just over a month old. Serum broth gave colonies all alike. Ordinary broth showed

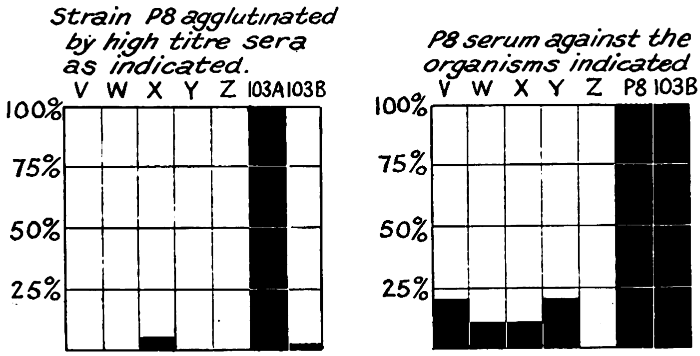


FIG. 4.

some ? B type colonies. Proved through sugars. Agglutinated gave the following results :—

TABLE XVI.

	103A	103B
	Per cent	Per cent
Broth colonies	100	100
Broth and serum colonies	66	1

It would therefore appear that the colony from the plain broth is a B type variant.

December 13. A subculture from the original strain and from the B type colony just isolated gave the following results :—

TABLE XVII.

	V	W	X	Y	Z	103A	103B
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Original ..	—	—	4	—	—	66	1·5
B variant ..	100	100	100	100	100	100	100

ATTEMPTS TO HASTEN THE PRODUCTION OF AGGLUTINABLE VARIANTS.

Various attempts have been made to hasten the production of agglutinable variants from the strains as isolated. Growing the organism in broth to which a few drops of 103A serum had been added proved successful in four out of twelve cases in which it was tried. In the other eight cases repeated attempts have been unsuccessful. In two of these B type variants

have not yet appeared; in two they appeared in cultures in ordinary broth to which serum had not been added; in four they appeared during routine subculture.

On the assumption that the production of B variants might rest on the presence of an enzyme, a broth-culture of 103B was made and filtered through a Chamberland filter. Some of the filtrate was added to fresh broth and the organism grown in this and then plated. This was, however, unsuccessful, and no B variant appeared.

Prolonged incubation—up to a month—in a broth medium was successful in two cases.

Two old strains have resisted all attempts to make them produce B variants. They have, however, produced variants of an entirely different nature, approximating closely to the R variant of the classical Flexner, but only agglutinating to about twenty-five per cent of titre with a serum prepared from a R strain of Z.

In two other strains, both the agglutinable variant and this R type of variant have been isolated.

Minor Variations in Agglutinability.

In the process of this investigation very many plates have been made and large numbers of colonies put through the same agglutination test time after time. It was repeatedly observed that minor variations in agglutinability occurred between colonies from the same plate and also sometimes in ordinary mass subcultures made from one agar slope to another. No satisfactory explanation of this phenomenon has been reached, and the

Table XVIII.

	B variant isolated	Development of B variant hastened by growth in broth containing 103A serum	Period between isolation and development of B variant	Colony characters of B variant			R type of variant developed
				Like 103 B	Clear	Like A variant	
103 ..	+		46	+			
Baye ..	+		?	+			+
Munuswamy	+		?	+			
D15 ..		−					+
D33 ..	+	−	?		+		+
D35 ..	+		?	+			
153 ..	+	+	358	+			
220 ..							+
B172 ..	+	+	7			+	
B199 ..	+	−	228	+			
B208 ..	+	+	36		+		
B215 ..	+	+	17	+			
P8 ..	+	−	15	+			
P41 ..	+	−	97	+			
P61 ..							
P81 ..	+	−	47	+			
Mh1 ..	+	−	121	+			
Md3 ..	+	−	72	+			

causes are probably very complex. They are definitely not related to the development of B variants. In one case these variations were noted a year before true B variants could be made to put in an appearance. One such variation can be seen in Table XII.

Table XVIII gives the principal findings in the eighteen strains that have been tested.

Relationship of this Mutation to others already Described.

While it is not the object of this paper to discuss in detail the significance of this variant, a brief comparison with other known mutations may be given.

(*a*) It is obvious that it bears no direct relationship to H and C, as seen in the enterica-salmonella group. The organisms under discussion are devoid of flagella, and agglutination in all cases is of a granular type.

(*b*) It differs fundamentally from the B to R mutation of the Flexner group. This has been already fully detailed.

(*c*) Relationship to the specific and non-specific or group phases, as observed by Andrewes in the salmonella group, requires more consideration. These, however, present the following characteristics: (1) They are present on isolation, and are not a late development; (2) no physical differences in specific and non-specific colonies have been observed; (3) changes from one type to the other occur.

In all these points there is variation from 103, the most important point being the third.

Further investigations along lines suggested by the above are in progress.

(*d*) That variants bearing a fairly close relationship to true "R" have been produced by some of these strains is a fact, the significance of which needs to be borne in mind.

It is obvious that much remains to be done in the investigation of this strain, which is the principal reason for the publication of this paper in its immature condition. There is ample scope in the military laboratories of India for such investigation.

Summary and Conclusions.

(1) 103 is a Flexner-like organism which has a claim to be considered pathogenic because of the way in which it occurs in cases of acute bacillary dysentery, because it has never been found in healthy controls, and because it bears a close antigenic relationship to known Flexner organisms.

(2) It has the property of producing a variant which is highly agglutinable with the usual Flexner sera. This variant at first occurs in the cultures side by side with the original type. It more or less rapidly comes to dominate the picture, and, finally completely "smothers" any of the original colony types which may be present.

(3) The variant once isolated has the following characters: (*a*) It breeds pure; (*b*) it may have physical characters which, in part, resemble the R variant of the recognized Flexners; (*c*) it has marked agglutinogenetic properties, and in its antigenic composition closely resembles Y, but is more sensitive to agglutination. Conversely, it is practically unrelated to Flexner R.

(4) The production of the variant may be hastened in some cases by growth of the organism in the presence of its homologous serum, in others by prolonged incubation in a broth medium.

(5) A more or less typical R variant has developed from four strains of 103.

Strain No. 170.

This strain has been encountered as follows:—

Bangalore, 1929, five times; Bangalore, 1930, four times; Secunderabad, 1928, once; Poona, 1931, once.

It has been found only in the stools of cases presenting symptoms of bacillary dysentery. These cases have in the main been mild, and correspond to the average Flexner infection as seen in India. It must be remembered that all cases are diagnosed on the clinical features of the case plus the microscopic characters of the stools, and hence are generally placed on appropriate treatment at a very early stage, a fact which no doubt greatly reduces their severity.

The following is a typical case history:—

Capt. B.—August 6, 1930. History of diarrhœa for four days, mucus having been present for the last two days, blood tinged for one day. Temperature 100° F. The specimen sent to the laboratory reached it five minutes from the time it was passed, and was a watery stool containing blood and mucus. Microscopically the exudate was that of bacillary dysentery. Plates made from the mucus showed many suspicious colonies, four of which were selected and tested. All turned out to be 170 type.

August 7. Watery stool with streaks of cellular mucus. Plates again produced many suspicious colonies. Of five selected, three were of the 170 type, the others not being dysentery organisms.

August 9. Symptoms have largely subsided. Stool sent to the laboratory was watery with a trace of mucus, non-cellular. Plates negative.

August 22. Watery stool with slightly cellular mucus. Plates negative.

August 25. Stools normal.

Biochemical reactions.—Lactose, no change; glucose, acid; mannite, acid; dulcite, no change; saccharose, no change; milk, acid, late neutral or faint alkaline; indol, negative. 170 thus corresponds exactly with the known Flexners.

Serological reactions.—(*a*) In relation to the high titre sera.

This organism has apparently no antigenic relationship to the classical

Flexners. It fails to agglutinate with any serum other than its homologous serum, even in low dilution, and its homologous serum does not agglutinate V, W, X, Y, and Z, 88 or 103A, although it does produce a peculiar powdery agglutination with 103B, to about fifty per cent of titre.

The agglutinogenetic properties of the organism are indifferent, and the highest titre reached in its serum was 1 in 1,000.

(*b*) In relation to the patient's serum. Of three tested, none has ever shown any agglutinins for this organism.

Conclusions.—While there are no serological grounds for considering this organism to be a cause of dysentery, the fact that it has been encountered only in the stools of clinical dysentery cases, and that it has biochemical reactions identical with the classical Flexners, gives it at least a claim to consideration.

Further, when the poor agglutinogenetic powers of the organism are considered, it is not surprising that the patient should develop no agglutinins.

Other Strains.

Other types are under investigation. Of the thirty-seven strains received from Secunderabad, seven are serologically of one type, which differs from any that have been yet described. This type has not, however, been isolated to date in the writer's laboratory, and for want of adequate data a description is not yet published.

So far, attempts to classify the remainder of the non-agglutinable strains that have been isolated have been unsuccessful, and as far as can be ascertained the latter are rather a mixed collection with very little antigenic relationship to one another. Much work, however, remains to be done before definite conclusions can be formulated. Nor must it be forgotten that only strains from the South of India have been examined. It is highly probable that similar investigations elsewhere will lead to the typing of further strains.

Tests which have not been Carried Out.

To forestall criticism, reference may be made to certain tests which have *not* been carried out in these investigations.

(1) Liquefaction of gelatine. The climatic conditions under which most of this work was done rendered this impracticable as a routine measure.

(2) Acid agglutination. Previous experience of this test in a similar investigation thirteen years ago, and again four years ago, was very unsatisfactory, and created the impression that the results of the test varied within such wide limits as to render it practically valueless. It has therefore not been employed.

(3) Testing of virulence by animal inoculation. This has been avoided for two reasons. First, because of a strong antipathy to experiments

of the kind. Second, because a perusal of similar experiments carried out by other workers raises the conviction that, unless the experiments be conducted on a scale quite outside the resources available to the writer, the results will be equivocal and valueless. At best, the logic of the conclusions drawn from such results is open to criticism. Injected intravenously into the rabbit in somewhat indifferently controlled doses, certain known dysentery organisms produce death, presumably chiefly from bacillæmia and toxæmia, but accompanied by certain lesions of the intestine. It happens, however, that very similar results are produced by other organisms which are not known to be pathogenic to man [9]. The value of such experiments with an unknown organism is therefore very doubtful, and at best the evidence can only be regarded as minor contributory evidence to the issue in question.

Acknowledgment.

In all these investigations the author had the loyal co-operation and help of the staffs of the District Laboratory, Bangalore, and the Southern Command Laboratory, Poona. In particular must be mentioned and thanked Assistant Surgeon L. C. Smith, and Jemadar J. Michael, of the Bangalore Laboratory, where the bulk of the work was done, and Jemadar Narain Singh, Southern Command Laboratory, Poona.

References.

[1] Medical Research Council, Special Report Series, No. 30.
[2] Medical Research Council, Special Report Series, No. 42.
[3] Bridges. Journal of the Royal Army Medical Corps, 1930, lv, 401.
[4] Manifold and De'Monte, *Indian Journal of Medical Research*, 1928, xv, No. 3, 601.
[5] Large. Journal of the Royal Army Medical Corps, 1929, liii, 334.
[6] Little. *Ibid.*, 1930, lv, 419.
[7] Andrewes. *Lancet*, April 20, 1918, 560.
[8] Medical Research Council, Special Report Series, No. 7, 90.
[9] Medical Research Council, Special Report Series, No. 6, 70, 71.

A STUDY ON THE PREVENTION OF INFLUENZA.

By Colonel G. DANSEY-BROWNING, C.B.E.

One of the many problems which a medical officer in charge of troops has to face is how to decrease the number of cases of influenza and of feverish colds, which, year in year out, interfere with the military training of the soldiers under his care.

He recalls with horror the coughing, sneezing crowd which throngs the medical inspection room during the winter months, and realizes that the real problem of influenza has not yet been solved.

Unfortunately, the textbook methods of prevention, however carefully carried out, are on the whole unsatisfactory. The infection is elusive. It slips through the most carefully thought-out defences, and unlike many other diseases, one attack confers but slight immunity.

In spite of all the work that has been done on influenza, in spite of the wealth of literature and the recently published epidemiological records, the latest investigations leave us with no definite information regarding the actual specific organism concerned.

The foregoing statement is to be found in the Special Influenza number of the *Practitioner*, published in February, 1919, and is as true to-day as when it was written.

In spite of this unsatisfactory position, there is a tendency to mark time ; to await guidance on the subject of prevention from further laboratory work. I submit that this is a mistake. The person who should be fully acquainted with gaps and potential sources of weakness in the lines of defence against influenza of any particular unit, is the medical officer concerned. By careful observation at the time he can often ascertain the special channels through which individuals become infected, and thus add materially to his knowledge of how to check its spread.

Observations of this nature will fall within the wide meaning of the term "medical research" used by the late Sir William Leishman to cover any means by which we, of set purpose and on a deliberate plan, strive to add to existing knowledge of the cause, prevention or treatment of disease.

The plan which I advocate has nothing original in the actual means of prevention employed, which consist in the usual routine precautions against direct or indirect transmission of the infection, in endeavours to raise immunity and to decrease the number of potential disease-carriers. In addition to these precautions, a carefully thought-out scheme of record is required, in which all essential factors concerning individuals attacked by the disease are carefully noted at the time that they are observed. It should be similar in form to the table of differences and resemblances used for noting down facts concerning individuals amongst whom an outbreak

of food poisoning has occurred. One such pro forma will be required for each unit under observation.

It will serve a double purpose. It will enable the medical officer to see at a glance where a gap in his defences has occurred when a soldier is attacked with the disease. It will also enable him to tabulate his observations so that at the end of the epidemic they may be compared with similar observations on other units elsewhere.

If it be decided to include in the plan prophylactic inoculation, it should be noted that a remarkable feature in the history of influenza is the change of opinion which has recently taken place regarding the prophylactic value of vaccines. In 1919 their value was generally appreciated both in this country and in America; Rosenau, Wynn and others strongly advocated their use.

Leishman gave the following figures from the Army Medical records of 59,144 men:—

	Number observed	Influenza per mille	Pneumonia per mille	Deaths per mille
Inoculated..	15,624	14·1	1·6	0·12
Non-inoculated	43,520	47·3	13·3	2·25

Hogarty, writing from Canada in February, 1919, stated that the only hope for prevention of influenza lay in the use of vaccines. W. H. Wynn was of opinion that 1,000 million *B. influenzæ* might confer immunity lasting several months, while that from 30,000,000 probably lasted only a few days. Recently published work has not confirmed these opinions; observations carried out in the winter of 1928—1929, on troops in the Aldershot and Southern Commands failed to demonstrate any beneficial results from the use of anticatarrhal vaccines. To what causes should this change of opinion be attributed? Is it due to changes in the composition, mode of sterilization, administration or dosage of the vaccines now employed?

It was known in 1919 that Pfeiffer's influenza bacillus was not the primary organism which caused the disease, although it played an important part in the production of the symptoms. Pneumococci and streptococci were considered chiefly responsible for the gravity of the secondary pulmonary complications. The primary infection was thought to be due to a filter-passing virus, and this view was confirmed by the findings of Nicoll and Lebailly.

It was agreed that the vaccine should be polyvalent and contain Pfeiffer's bacillus, pneumococci and streptococci in various proportions, to these *Pneumococcus hæmolyticus* and *M. catarrhalis* were subsequently added, and the vaccine became known as anticatarrhal vaccine. The War Office Conference recommended that it should be sterilized at 55° C., and contain 0·5 per cent phenol for preservative purposes. The first dose consisted of *B. pfeiffer* 30 millions, pneumococci 100 millions, and streptococci 40 millions The second dose was double that of the first. In

order to avoid a negative phase there was an interval of ten days between the doses. The content of *B. pfeiffer* in this vaccine was subsequently found to be too little and it was increased.

Rosenau pointed out the necessity of using strains of organisms recently isolated, and giving them in adequate dosage.

Major N. T. Whitehead has kindly furnished me with notes on the composition of the anticatarrh vaccine now issued by the R.A.M. College, of which the following is an extract:—

(*a*) *B. pfeiffer*, 400 million per cubic centimetre, from strains isolated in 1920 and 1923.

(*b*) *Streptococcus hæmolyticus*, 30 million per cubic centimetre from National Collection of Type Cultures (1928).

(*c*) *Streptococcus non-hæmolyticus*, 30 million per cubic centimetre, from National Collection of Type Cultures (1928).

(*d*) *Pneumococcus*, Type I, 80 million per cubic centimetre (1928).

(*e*) *Pneumococcus*, Type II, 80 million per cubic centimetre (1928).

(*f*) *M. catarrhalis*, 30 million per cubic centimetre (1921 and 1925).

(*g*) *B. coryza*, 30 million (1922, 1923 and 1924).

(*h*) *B. friedländer*, 50 million (1925).

All these organisms are killed at 60° C., except *B. friedländer*, which is killed with phenol 0·5 per cent.

The vaccine, as issued, contains 0·5 per cent phenol as a preservative.

None of these vaccines contains antigen to the primary virus of influenza, but only antigen to the secondary catarrhal, streptococcal or pneumococcal infections to which the clinical importance of the disease is chiefly due. The success achieved in immunization against canine distemper by recent intensive work at Mill Hill, leads one to hope that, by analogous methods, an antigen to the virus of influenza may, before long, be obtained. In the meantime, the composition of the secondary vaccines should be reviewed and endeavour made, by using more recently isolated strains and seeking improved methods of preparation, to provide antigens which will give results comparable to those recorded in 1918 and 1919

A possible explanation of the discredit into which prophylactic inoculation for influenza has fallen of recent years is that statistics do not clearly show what dosage or vaccine has been employed. An observer in the Aldershot Command, who recently made a careful analysis of the results of prophylactic inoculation with mixed cold vaccine of 9,000 men, was unable with the data at his disposal to place in separate categories men who received one dose, two doses, or two courses of the vaccine. This difficulty would not have been met with if details of the inoculation had been entered up at the time in the appropriate pages of the Soldiers' Pocket-book, A.B. 64, which is carried on the person.

Another fallacy is the tendency to class together the results of vaccine therapy on tonsillitis and on influenzal sore throat, two distinct clinical entities which occur at different seasons of the year.

In Army practice, inoculation is not compulsory. The medical officer who wishes to give this method a fair trial has to rely on personal persuasion, opportunity and tact. Special inoculation parades are of little value, as few volunteers attend. A good method is to offer prophylactic inoculation to all men who report for medical inspection on rejoining the unit on return from courses or from leave. Volunteers can then be called for from men who have not left the station, and many will attend. The matter should be explained in the annual lectures on sanitation and, when opportunity occurs, in informal talks.

Observations at Longmoor.

Longmoor is a hutted camp in the Aldershot Command. Its garrison is composed of one Medium Brigade of the Royal Artillery and a Railway Training Centre of the Royal Engineers. The strength of troops varies from 600 to 807 men, with 27 officers, 58 women and 89 children living in the camp. The huts are of wood or of galvanized iron. The walls are double and lined with felt. The roofs are of galvanized iron and the floors are above ground-level. They were built in 1907 and have been kept in good repair. Their size conforms with the War Office scale. There is a minimum floor space per bed of 60 square feet, with adequate height. The average number of occupants per hut is 19. There is at least 6 feet of wall space and a 3-feet interval for each bed. Twenty-seven of the families are housed in brick buildings ; the remainder are in huts. These buildings and huts are partitioned off into A, B or C types of married quarter in accordance with the authorized War Office scale.

Throughout the year precautions against influenza and droplet infection are in force. They are based on Command Orders, an extract of which is given in Appendix I of this article. Gargling, as a preventive measure, is also carried out by the troops daily, under supervision, during the winter months. During the winter of 1930-31 there was an epidemic of influenza in the Aldershot Command. Although a number of troops were attacked, the mortality was inconsiderable.

In Longmoor, where there was a mild epidemic in January, February and March, I set myself the task of finding out by observation the answers to the following questions:—

(1) The relative incidence of influenza amongst single men living in huts with beds properly spaced as compared with that amongst the occupants of married quarters.

(2) The incidence of the disease as influenced by the use of drinking and eating implements sterilized by hot water after preliminary cleansing.

(3) The effects of inoculation with mixed cold vaccine on the severity of the disease.

In formulating these questions I was aware that the number of data I could collect at Longmoor would be insufficient, owing to the small size of the garrison. I thought, however, that the Longmoor figures, if carefully

tabulated and correlated with similar observations made elsewhere, might be of value in drawing up future plans for the prevention of the disease.

Effect of Spacing Beds.

The incidence of influenza at Longmoor amongst 525 men housed in huts with properly spaced beds during the months of January, February and March, 1931, was 17 as compared with a case incidence of 39 amongst 205 occupants of married quarters during the same period. Double beds were provided for the families, on the scale of 1 double bed per room. The number of men, women and children who were attacked is shown in the following table :—

TABLE A.

Occupants		Number	Cases of Influenza	Ratio per mille
Single men's huts ..	Men	525	17	32·38
Married quarters ..	Men	58	8	137·9
	Women and children	147	31	210·9
	Total—Married quarters	205	39	190·2

Both the men's huts and the married quarters were provided with adequate means of ventilation. The authorized issue of single beds for children over 5 years of age, now allowed in type A quarters, had not been made at the time of the epidemic. Single beds for children are not issued in type B and C married quarters, under existing regulations.

Effect of sterilizing drinking and eating implements with hot water after washing up.

Dr. J. G. Cumming claims that indirect transmission of influenza germs, by means of water used for washing up, is the most important source of infection amongst troops, and if this channel is efficiently blocked, other causes of infection may be disregarded. In support of this argument he quotes a group of 3,115 American troops, whose washing up of mess kit in 1918-19 was carried out in water of a temperature ranging from 76° to 100°c, and compares the incidence of influenza and other droplet infections amongst them, during a period of ten months, with the case incidence amongst 2,856 men who used lukewarm water. He states that the ratio of cases in the protected and unprotected groups was as follows: Meningitis, 1 to 28; diphtheria, 1 to 2; measles, 1 to 17; influenza, 1 to 4; pneumonia, 1 to 8. 85 per cent of the cases of saliva-borne diseases occurred in the unprotected group.

At Longmoor great difficulty was found in getting sufficient hot water of the required temperature for sterilizing a large number of plates. Steam was not available.

One group of 230 men, whose washing up arrangements were at times faulty, had 10 cases of influenza spread over the whole epidemic period, whilst a group of 275 men had 7 cases until their arrangements were improved, and then they had none. How far this was due to the washing up

and how far to other causes, I am unable to say. In both groups cresol solution was added to the hot water used for sterilizing the plates.

I am not aware of any more recent work on this subject.

Effects of Prophylactic Inoculation.

The troops at Longmoor had a high percentage of prophylactic inoculations during the winter of 1930-31. Inoculations were commenced on November 18, 1930, and continued during December and January, 1931. Six hundred and forty-three "other ranks" received one dose of 0·5 c.c. of the War Office "mixed cold vaccine," whilst seventy-one received treble that amount, i.e., 1·5 c.c. in two doses. 93 men were uninoculated. The average strength of the Longmoor garrison during the epidemic period, January to March, 1931, was 627 other ranks. The discrepancy between this figure and the number of men inoculated is due to daily fluctuations in strength on account of arrivals and departures from and on furlough, or transfer to other stations.

Table B shows the incidence of influenza and bronchitis at Longmoor

TABLE B.—INCIDENCE OF INFLUENZA AND BRONCHITIS AT LONGMOOR DURING JANUARY TO MARCH, 1931, AS COMPARED WITH INCIDENCE AMONGST TWO CONTROL UNITS STATIONED AT BORDON, WHO WERE NOT INOCULATED WITH PROPHYLACTIC VACCINE.

1. STATION	LONGMOOR	BORDON	BORDON
2. UNIT	3rd Med. Brigade, R.A. 8 and 10 Rly. Coys., R.E.	1st Border Regiment	1st Royal Scot Fusiliers
3. AVERAGE STRENGTH	627	388	378
4. INOCULATION STATE	One dose, 80 per cent; Two doses, 9 ,,; Uninoculated, 11 ,,	*Nil*	*Nil*
5. CASES OF INFLUENZA—			
(*a*) Number treated in barracks, including detained cases in Reception Station ..	17	12	9
(*b*) Number treated in hospital, including men treated in married quarters ..	6	17	1
(*c*) Total number of cases of influenza	23	29	10
(*d*) Ratio per mille to strength	36·68	74·75	26·39
6. CASES OF BRONCHIAL CATARRH—			
(*a*) Number treated in barracks, including detained cases in Reception Station ..	1	7	8
(*b*) Number treated in hospital, including men treated in married quarters ..	1	14	4
(*c*) Total number of cases of bronchial catarrh ..	2	21	12
7. COMBINED NUMBER OF CASES OF INFLUENZA AND OF BRONCHIAL CATARRH—			
(*a*) Numbers	25	50	22
(*b*) Ratio per mille to strength	39·71	103·5	58·2
8. CASES OF INFLUENZA WITH PNEUMONIC COMPLICATIONS	*Nil*	2	1
9. MORTALITY	*Nil*	*Nil*	*Nil*

during the epidemic period and compares it with similar data of two control uninoculated units stationed at Bordon.

Table C shows the relative number of cases of influenza and bronchitis which occurred at Longmoor amongst men who received one or two doses of mixed cold vaccine, as well as amongst men who were not inoculated.

TABLE C.—INCIDENCE OF INFLUENZA AND BRONCHIAL CATARRH AMONGST INOCULATED AND UNINOCULATED TROOPS AT LONGMOOR FROM JANUARY 1, 1931, TO MARCH 31, 1931.

1. Dose of mixed cold vaccine administered	1 dose of 0·5 c.c.	2 doses of 1·5 c.c. in all	*Nil*
2. Numbers inoculated	643	71	Uninoculated, 93
3. CASES OF INFLUENZA—			
(*a*) Number treated in barracks, including men detained in Reception Station ..	15	1	3
(*b*) Number treated in hospital, including men treated in married quarters ..	3	*Nil*	1
(*c*) Total number of cases of influenza	18	1	4
4. CASES OF BRONCHIAL CATARRH—			
(*a*) Number treated in barracks, including men detained in Reception Stations ..	1	*Nil*	1
(*b*) Number treated in hospital, including men treated in married quarters ..	*Nil*	*Nil*	*Nil*
(*c*) Total number of cases of bronchial catarrh ..	1	*Nil*	1
5. COMBINED NUMBER OF CASES OF INFLUENZA AND OF BRONCHIAL CATARRH—			
(*a*) Number	19	1	5
(*b*) Ratio per mille	*29·55	† 14·08	‡ 53·83
6. Number of cases with pneumonic complications	*Nil*	*Nil*	*Nil*
7. Total mortality	*Nil*	*Nil*	*Nil*

* Calculated on 643 men inoculated with one dose of 0·5 c.c.
† Calculated on 71 men inoculated with 2 doses of 1·5 c.c. in all.
‡ Calculated on 93 men uninoculated.

The general precautions against "droplet infection" outlined in Appendix I of this article were in force both amongst the Longmoor units and the controls stationed at Bordon; whilst, in addition, permanganate of potash gargles were used daily by the troops under supervision, before the morning parade.

At Longmoor, a careful record was kept daily of men reporting sick with influenza or bronchitis, showing state of inoculation, and of the huts occupied and dining halls used by each case.

As regards Table B, the figures for influenza considered separately show that the troops at Longmoor, of whom only 9 per cent were fully inoculated, occupied an intermediate position as regards incidence of this disease to the two uninoculated control units stationed at Bordon.

Table C shows that all the influenza cases at Longmoor, with the exception of one, occurred in the uninoculated or in the partially inoculated groups.

If influenza and bronchial catarrh are considered together, the Longmoor troops, in contrast to the Bordon controls, were more favourably placed. The ratio per mille of the combined influenza and bronchial catarrh figures was 39·71 per mille at Longmoor, as opposed to 103·5 and 58·2 respectively for the two control units.

This is in keeping with what was expected from the use of a mixed cold vaccine for influenza prophylaxis. It contains no antigen to influenza virus; its value lies in its effect on concomitant catarrhal and pneumonic infections which complicate that disease. When administered in single non-repeated doses of 0·5 c.c., it seems to have been of transient benefit; when the dose was doubled and repeated its value was much more marked.

There was only one case of influenza amongst the men at Longmoor who received two doses of the vaccine. There were no cases of pneumonia, whilst in the control Units at Bordon there were three. In neither station was there any death from the disease.

Although these results are encouraging, the figures quoted are too small to permit of conclusions to be drawn from them as to the probable value of prophylactic inoculations against influenza when dealing with large bodies of troops. They can only be used to show the effect of inoculations employed with general methods of prophylaxis against influenza on a small scale.

In taking these figures into consideration, it must be observed that the beneficial results were not entirely due to the effect of the vaccine alone. The precautions outlined in Appendix I of this report were carried out both among the inoculated and among the uninoculated men, but in the case of the former, a careful record of each case was made at the time of its occurrence on an appropriate form. This permitted the source of the infection to be investigated without delay and any failure in the precautionary measures adopted to be at once remedied. Unfortunately the number of observations is limited and does not permit of conclusions being drawn as to the value of prophylactic therapy on large bodies of troops.

The higher percentage of cases of influenza amongst occupants of married quarters, where general precautionary methods were less adequately employed, leads me to believe that inoculation alone was only one of the factors in diminishing the incidence of the disease.

Summary.

I have given a bird's-eye view of the unsatisfactory position of our knowledge of influenza. I have pointed out the need for further clinical and bacteriological research. My observations at Longmoor show the beneficial effects obtained in a small station by the use of prophylactic anti-catarrh vaccine, when given in adequate dosage, and when combined with general precautionary measures against the disease.

ACKNOWLEDGMENT.

I owe thanks to the D.D.M.S. of the Aldershot Command for permission to publish this study and for the extract of general precautionary measures used against influenza in this Command.

I am indebted to Lieutenant-Colonels C. E. W. S. Fawcett, W. C. Smales and H. L. Howell for some of the data, as well as to Serjeant J. Wallis and Corporal Turner of the R.A.M.C.

I acknowledge help given by the Librarian of the British Medical Association in looking up literature.

BIBLIOGRAPHY.

LEISHMAN, SIR WILLIAM. "Research in the Medical Services." Presidential Address to the War Section of the Royal Society of Medicine on October 12, 1925, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, December, 1925, xlv, 401.

WYNN, W. H. "Use of Vaccines on Prophylaxis and Treatment of Influenza," *Journal of Royal Sanitary Institute*, 1920-21.

EMERY, W. D'ESTE. "Use of Vaccines in Influenza." Special Influenza Number of the *Practitioner*, February, 1919.

CADNAM. "Article on Influenza," *Canadian Medical Journal*, 1919.

ROSENAU. "Article on Influenza," *Minnesota Journal of Medicine*, June, 1929.

CUMMING, J. G. "Saliva-borne Disease Control: Eradication," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1931, lvi, 101.

APPENDIX I. PRECAUTIONS AGAINST INFLUENZA.

EXTRACT FROM ALDERSHOT COMMAND ORDER No. 43, DATED JANUARY 8, 1931.

Officers Commanding units will ensure that the following preventive measures are taken as far as practicable:—

(i) That all ranks of their units who suffer from bad or feverish colds, sore throats, etc., report sick immediately.

(ii) That overcrowding is avoided. In barracks and huts, a minimum of sixty square feet of floor space and six feet of wall space per bed will, where possible, be allotted. Beds will be separated by a space of at least three feet. Where wall space does not permit of this distribution of beds, alternate beds will be turned so that the occupants are separated by as much space as possible.

As influenza infection is usually spread by infected men coughing and sneezing on to others, it is obvious that this "spacing out" of beds is all-important.

(iii) That all ranks are warned not to attend crowded places of amusement in civil areas whilst influenza is prevalent.

(iv) That free ventilation of all barrack rooms, huts, recreation rooms, institutes, etc., is ensured. The upper sashes of windows in these rooms will always be kept open to the extent of, at least, one foot, except in inclement weather, when those on the windward side may be closed. During the time barrack

rooms, huts, recreation rooms, institutes, etc., are vacated in the morning, the upper and lower sashes of the windows will, weather permitting, be opened wide for at least one hour in order to flush thoroughly each room with fresh air.

(v) That sawdust is spread on the floors of rooms used for band practice, and that, immediately after the practice the sawdust is swept up and burned.

(vi) That, after use, all drinking vessels, eating utensils, knives, forks, spoons, etc., are washed in the ordinary way and then sterilized by immersion in boiling water.

(vii) That, in order to avoid chills, all occupied barrack rooms, huts, recreation rooms, institutes, etc., are kept at a reasonably warm temperature.

(viii) That the floors of barrack rooms are not scrubbed more often than is essential. Frequent wet scrubbings are not necessary and dry scrubbings should be substituted. When wet scrubbing is necessary, it will be done early in the day, as little water as possible being used. Creosol will be added to the water used for scrubbing so as to make a solution of 2½ per cent. The floor will be carefully dried after scrubbing. Wet scrubbing will only be done on a fine day. Before scrubbing is commenced, fires will be lighted and windows opened wide.

(ix) That the danger of wearing wet clothing, socks, boots, etc., is impressed on all ranks, and men be urged to change wet clothing, socks, boots, etc., at the earliest opportunity. After sweating heavily, men will be encouraged to have a rub down with a towel and to put on a dry vest.

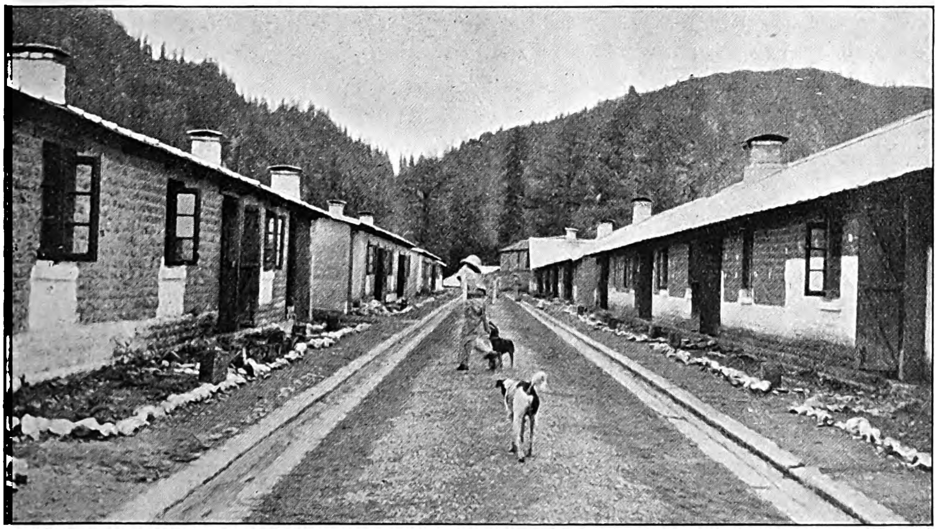
Overcrowding in cinemas and other places of entertainment is not permitted. The numbers admitted will be limited to the normal seating accommodation.

OUR STATION.

By OLA.

(*Continued from p.* 118.)

The East End institutes formed a bastion in the north-east angle of the perimeter. Here the Parsi contractor, Mr. Ginwala Attabhoy, was in deep conclave with Khan Sahib Taffazal Hussain and Messrs. Bhag-Mal, Jag-Mal and Sons. Whether these gentlemen were holding a miniature Round Table Conference, or merely discussing how to run an emergency regimental institute for a beleaguered garrison, it is impossible to say. When I asked Mr. Hanuman Junwar, C.E.O., Kaiser-i-Hind (3rd Class), he replied—looking hard in the direction of the Khan Sahib—"Subversive Khilafat politics no doubt, sir."



The East End Institutes.

The C.E.O. and the Khan Sahib did not find life too easy that day. Owing to constricted space they were compelled to meet face to face, and almost forced to rub shoulders with each other every now and again; but at the finish they were no nearer to settling the communal question than they were at the start.

Mary spent the afternoon wandering about, apparently in an aimless fashion, here, there, and everywhere. He looked bored, and even sheepish, as if he were not enjoying the game of "let's pretend." But Mary was

observant, his eyes were open; and this we discovered later on, at the conference, when—amongst other things—he pointed out to S.M. Roster that the Revd. James Cloister, though marked "present," was actually absent.

We were all taken aback. I am afraid that no one, except Mary, had noticed the absence of Jerks.

The fact was that Jerks had not considered it incumbent on him to attend this parade.

Mary left it at that; he knew that the defaulting clergyman would have things made very unpleasant for him by the all-powerful S.M. in the course of the ensuing two or three weeks.

Mr. Brikhbhan Chatterjee attended by proxy. He was represented by 2nd class postal peon Pritti Ram Dutt who brought a note from his chief. "Respected Sir—I have received secret intimation re parade. Doubtless your servant should toe line at same, but Indian Post and Telegraph Guide, sec. 2, sub-sec. III. (f) warns me anent venal offence of promiscuous absenteeism. Sir—to prove alibi would be frightfully difficult. Therefore I push forward peon P. R. Dutt as substitute. Hoping Your Honour will excuse the trouble, and praying for Your Honour's long life and prosperity."

Mrs. Dubbin was discovered to be sobbing violently. She was being comforted by Mrs. Pipeclay—herself on the verge of tears. The two women were ringed round by little Dubbinses and Pipeclays, all suffering from acute depression, and all vocally advertising the fact.

The Honble. Charlotte elicited the information that both women—and others as well—had heard that the practice was not a rehearsal at all, but the real thing. The unfortunates begged to be allowed to say farewell to their husbands before departing for another world.

The Honble. Charlotte soon laughed away their fears; but this was an unpleasant and unexpected development, one which had to be taken seriously and dealt with firmly.

The gossip was traced quickly to its source—Mrs. Slings. Milord, who has a special aversion to those guilty of spreading alarm and despondency amongst the troops, read Mrs. Slings a severe lecture and sent her home under escort.

After that the mercury rose again; but the early departure of Mrs. Slings had an unlooked for result in another direction. Mrs. Dough, supported by some of those malcontents who are always agin government, professed to see in Mrs. Slings a privileged person, one who had been granted the favour of leaving—under male escort too—before the curtain had fallen on a very dull play. So Mrs. Dough and Co. also started off on the home trail, and had to be headed back by an officer's patrol.

Once again Milord read the riot act and cheerfully announced that, if necessary, he was prepared to carry on with it till Christmas. However, we did not all share his optimism: these signs of restiveness were becoming too frequent: everyone was hungry as well as cold: the sun was nearing the western horizon.

There remained a good deal to be done. "G" said: "Half an hour more." "A" said: "Half an hour more—after 'G' has finished." "Q" said: "I have only just begun." The Honble. Charlotte said: "Bad staff work. I vote for the 'Cease Fire.'" As the Honble. Charlotte can always count on a majority, the orderly bugler was summoned.

The bugler arrived accompanied by Bandmaster Piccolo, 1st Goomshire Regt. Bandmaster Piccolo is a short, blonde, baldheaded man. He is introspective, sensitive and sentimental. His chin does not denote determination, but his mouth registers obstinacy, a difficult man to deal with—unless you are prepared to say, "I am a boob. You are a great musician. Have it your own way." Inevitably delay occurred in discussing the musical programme. It was agreed that, after the "Cease Fire" and "The King," the garrison should march out with the honours of war and headed by the band.

But what should the band play? That was the question.

The bandmaster had set his heart on a certain piece. "If I might suggest sir—" was how he began, but we all knew what he meant and we all feared the worst.

His choice was "Abide with Me."

Pom glared at Piccolo, who glared back unabashed.

Milord said "Damn!" and strode off in high dudgeon.

Caesar pointed out the utter inappropriateness of the choice to the circumstances.

Mary expostulated gently.

The Honble. Charlotte said: "How perfectly lovely, Mr. Piccolo! and *nobody* can play it as you can, everybody says so. But why not keep it until we are actually attacked? Surely that is the time for that melody—*as you play it.*"

Piccolo beamed. "Certainly, madam, I quite agree. What would you like?"

"I vote for 'Roamin' in th' gloamin'."

Carried *nem. con.*

So we all went roaming in the gloaming homewards, well satisfied that the defence of Likhnabad was in safe hands.

Our Station is nothing if not versatile. While we are quite ready, if need be, to tackle the Shaitan Khel and the Zulmzai, we are not really a bellicose community. As everyone knows, the last person who wants war is the soldier; he—and his wife—are quite content to pursue the paths of peace with steady steps, unruffled minds and calm hearts. Provided a little notice be given, Our Station is prepared to submit to any form of inquiry which anybody, such as the League of Nations, might think fit to impose.

We should enter an investigation of this kind with a *dossier*. The front page of this *dossier* would be a copy of the programme of Our Station Week.

What is "A Week"?

A Week is a period which lasts from five to ten days, during which friends, acquaintances, relations and strangers invade your sanctity, drink you out of hearth and eat you out of home. These people, known and unknown, devour, dance, laugh, clap their hands, scamper, play and depart into the void with all the best prizes, leaving you bankrupt and exhausted, your house chaotic and your servants demoralized or imbecile.

A Week is the price of respectability and standing.

No cantonment in India has any right to call itself a cantonment unless it runs a definite and distinctive Week. A cantonment without a Week is like a sentry without arms, or a woman without charm.

Our Station Week began on a Monday morning in the month of June. All the best Weeks begin on a Monday, because this permits of the shoal of visitors arriving for tiffin on the previous Saturday. Also, such weeks end on a Saturday night, so that the guests may have a quiet Sunday in which to recover. The hosts take longer than twenty-four hours to recover but—as usual—they and their affairs are not taken into consideration.

Here, then, is a copy of the programme:—

OUR STATION WEEK.

MON.	Morning.	H.M. The King-Emperor's Birthday Parade.
	Afternoon.	Baby Rally.
	Night.	Fancy Dress Dance.
TUES.	Afternoon.	Dog Show.
	Night.	Whist Drive.
WED.	Afternoon.	Polo Match.
	Night.	Competition Dancing.
THUR.	Afternoon.	Children's Sports.
	Night.	Treasure Hunt.
FRI.	Afternoon.	Tennis Tournament.
	Night.	Concert.
SAT.	Afternoon.	Parents' Day.
	Night.	Cinderella Dance.

Were I to give you a true and faithful account of our Week we should be here until the shadows of the pines lengthened to vanishing point : until the sun sank in a blaze of red and yellow behind Killangadr : until the green valleys became blue and then disappeared in a violet mist : until the birds ruffled their feathers, became silent, and settled down for the night. We should be here until the quartered moon rose to dim the brilliancy of the stars and suffuse the distant snows with a ghostly, silvered light.

You might not notice all these things.

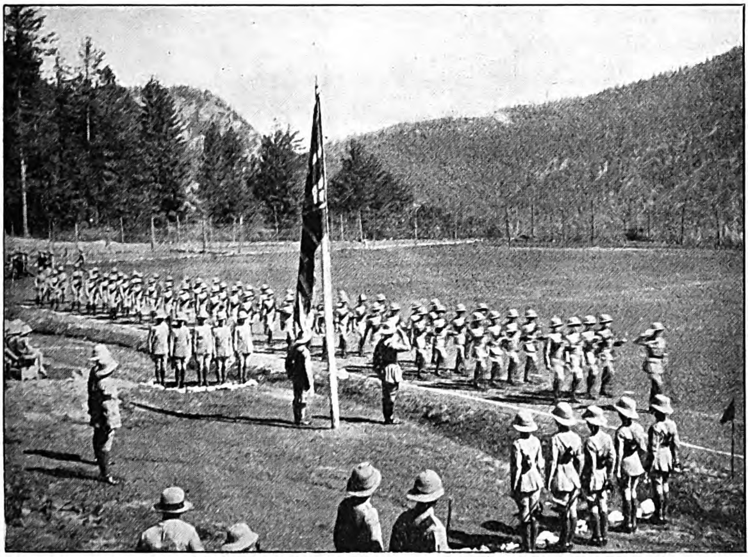
You might observe an owl flitting across the face of the night, or hear

the blood-curdling yells of the jackals prowling on the jungle's edge, or smell the smoke of the dung fires cooking the evening meal.

You might miss the pageant but see the flash of a diamond, the glint of white teeth or the sweep of a carefully cultured beard.

And so it seems to me that, at this late hour, 'tis well not to attempt to set before you the whole story: a few of the choicer episodes will suffice. If they take your fancy, come to Our Station Week next year. You will be greeted with the magic word which adorns every triumphal arch in this great land—the word "WELCOME!"

All units in the garrison took part in the Birthday Parade—even the I.H.C. and the police, who lined the ground. It was not a big parade,



H.M. The King-Emperor's Birthday Parade.

because the women were not allowed inside the ropes; but what it lacked in size it made up for in soldierliness and loyalty.

As this function was taken seriously, the Week committee considered that, by way of counterpoise, it should be followed by the Baby Rally.

This was an extraordinary error of judgment, a grievous estimation of human nature, a complete failure to appreciate the female point of view.

Of course the rally proved to be far and away the most serious item in the whole programme.

Fortunately this was realized in time by the Honble. Charlotte and the M.O.: had it not been for their perspicacity our Week might have come to a sad and sudden end on the afternoon of the first day.

However, as things turned out, the rally was as successful as it was serious: that is to say, it was a *succès fou.*

What was the secret of the success?

Well, there were several secrets. Perhaps you would like to make a note of them? Nothing is more productive of real harm than a mismanaged baby show.

(1) A baby show is not to be lightly undertaken.

It requires careful and meticulous organization beforehand. The smallest points have to be thought out and provided for; and, while the affair is in progress, it must be closely watched and guided throughout; the slightest deviations from the conditions and rules must be swiftly and firmly checked.

(2) With the exception of the babies, everyone present—the officials, the judges, the mothers and the spectators—should understand what is going on: the points for which marks are allotted: the system of judging and marking, and so forth.

They should be made to feel that here is a fair field and no favour; that searching impartiality is the key-note and patient skill the instrument; that justice will be done e'en though the heavens fall.

(3) Consultations between judges, and the register of marks, must be kept secret. This is very important.

(4) The prizes should be worth competing for.

It gives Mrs. Cartridge no satisfaction to show Mrs. Slings a celluloid rattle (made in Germany) and to say—"My little Hubert won that at the Baby Rally: first prize." Mrs. Slings merely sniffs. But if the first prize is a Turkoman rug, or something of the sort, Mrs. Cartridge values the acquisition and is proud of her offspring's prowess, while Mrs. Slings spends a delightful morning in trying to estimate how much the rug cost.

The three dances were open to all ranks; but from this it does not follow that they were democratic affairs: the manners and customs of Terpsichore in Finchley and Hammersmith are not those of Terpsichore in Piccadilly and Mayfair. To be sure, our dances were full of conviviality and comradeship; but there was no intimacy, much less familiarity, in the proceedings.

You might sit down, but you might not sit out.

Why?

Because the serjeants' mess took care that its representatives should hold the balance of power on the dance committee.

The result was instructive, and also strictly in keeping with the traditional conventions which still govern serjeants'-mess dances in all the oldest and best units.

Thus, Corporal Saugor's suggestion that a small dance band be imported from Likhnabad, was frozen at birth. The band of 1 Bn. the Goomshire Regiment floundered through the cotton field and stuck in the melon patches of ol' Virginny, encouraged by the fact that jazz and elephants have a common land of origin.

Mrs. Spavin came to the first dance dressed as a little girl: time, 1837. A dainty pair of frilly trousers, adorned with pink bows, descended below the edge of her skirt and encased her shapely ankles. The serjeants' mess members on the committee approached Trooper Spavin and ordered him to remove his wife and the offending garment as well. Mrs. Spavin retired, hitched up the ankle frills by means of safety pins, and re-entered as pretty as before.

However, her enterprising friend, Mrs. Dock, tried to carry immodesty to an extreme degree.

Mrs. Dock attempted to enter the hall attired as Dick Whittington in tights.

By the grace of Providence, operating through the vigilance of the provost-serjeant, Mrs. Dock was stopped in the verandah and never appeared at all.

The Honble. Charlotte wore a gown which displayed a large area of her natural beauty. This gave rise to many whispered comments, all of the same type, e.g., " My—ain't she lovely ! "

Such is Service democracy.

The styles and methods of the dancers differed, roughly speaking according to rank. Thus, troopers and privates inclined to the healthy romp; corporals favoured fancy steps and elaborate movements, usually of their own inventing; and W.O.s and serjeants two-stepped with a ponderous agility well suited to their gravity and earnestness. It was jazz built on the Boston, the Lancers, the *Dee*-Alberts and the Haymakers' Jig.

Many of those people were born dancers ; but they were of the Douglas-Blackpool school. Not one of them descended to the lazy, bored shuffle of the officers' club. True, Q.M.S. Partworn—always a bit of a sycophant—attempted to meander sleepily round the dance floor with that superior person, Mrs. Spurs, and—'tis said—at the latter's instigation. This momentary lapse from good form was speedily dealt with by S.M. Roster.

" 'Ere, Quarter! What d'ye think you're doin' ? Qualifyin' for the dole ? "

The Q.M.S. woke up and, after the second encore, Mrs. Spurs felt that she had earned her rest and gingerade.

In the matter of refreshments, too, the serjeants' mess ruled the roost. For the ladies, port cum lemonade was *de rigueur*; and, for the men, beer from Likhnabad was the beverage. The officers, as guests, were provided with whisky (3 parts) and soda (1 part).

Anyone below the rank of warrant officer who showed signs of rowdiness, or who tried to be funny, was promptly conducted outside and advised to go home. If this advice were not taken he was conducted home by a posse of non-dancing stalwarts who were specially detailed and paid for this duty.

As a fact, the disturbers of the peace could be numbered on the fingers of one hand. Whether this was due to the deterrent effect exercised by the presence of the stalwarts, or to our temperate and law-abiding ways, does not matter. It was a creditable tally.

In connection with these dances, there was only one thing which did not go with a swing, and that was conversation.

It is remarkable, and often embarrassing, to hear what Mrs. Surcingle or Mrs. Pipeclay will say in the out-patient consulting room. But, at a dance, can you induce these same ladies to converse naturally and without restraint?

You cannot.

There are circumstances in which small talk kills the spirit of democracy.

The dog show was not such a serious business as the baby rally; but, judging from the number of entries, it was almost as popular.

One of our visitors, a padre, took umbrage when our Mr. Cloister urged him to enter his Pomeranian (*sic*) in the class for The Ugliest Dog. In

The Dog Show I.

photograph No. I the visiting cleric is seen trying to compose his ruffled feelings under Mrs. Klaxon's soothing influence. The photograph also shows the judges at work in this class. Mercifully, the photographer managed to keep the competitors out of the picture.

The photographs numbered II and III illustrate two phases of The Handy Dog class. For this competition the instructions were as follows:—

(1) The dog, held on the leash by a child, races for a distance of thirty yards.

(2) The dog, held by a friend of the owner, trundles wheelbarrow fashion for a distance of twenty yards.

(3) The owner carries his dog in his arms up a hill: distance, fifty yards.

(4) The dog is let loose and directed to the starting point. First over the line wins.

In this event everyone concerned, from the children to the officials, had a difficult and more or less precarious task. The outcome was surprising: S.S.M. Oddson won with a big and very heavy mongrel hound.

Another amusing competition was that for The Best Tail Wagger. The winner, a small brown nondescript, kept her caudal appendage flapping for twenty-two and a half minutes without a stop.

The show was much enlivened by a succession of fights—happily without serious injury to dog or man.

I am tempted to tell you more: of how Privates Cartridge and Magneto, disguised as The Two Black Crows, brightened the Children's Sports; of how Father Francis Mary conducted Parents' Day to his own credit and everyone else's satisfaction; of how Jerks fell down a khud during the Treasure Hunt, and was removed to hospital with a broken collar-bone; of how Drummer Sparelace fared after attempting to sing an uncensored ditty at the "gaff"—yes, and still more. But as neither your interest nor my staying powers would outlive the strain, I shall end with a short account of the knock-out Polo Tournament, as reported in the "Breastplate"—the regimental magazine of the 22nd Cuirassiers.

Our Station Polo Tournament.

This memorable event of the Week was played in fine weather on the garrison recreation ground before a large crowd of spectators.

First Round	Final	Winners
West Enders / *Our Station Staff*	*Our Station Staff*	*East Ende*
East Enders / *The Week Visitors*	*East Enders*	

Each team consisted of two officers and two "other ranks."

Four chakkars, each of five minutes, were played in each game; and no pony was allowed to be ridden in more than one chakkar. Thus, each member of the East End team rode twelve different bazar tats during the course of the tournament.

Captain G. H. Harness was the first to canter on to the ground. This famous player was mounted on a razor-backed chestnut with a mouth like a brass-bound box.

The gallant captain twirled his stick. The chestnut lowered her head and planted her hoofs firmly and suddenly in the sand.

Captain Harness described a graceful parabola before landing on his head and executing a clumsy somersault.

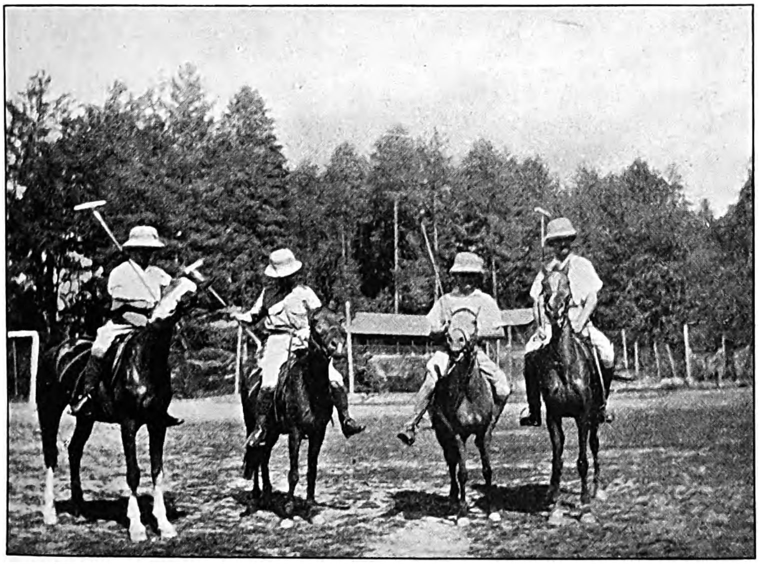
Your correspondent felt that this was an excellent beginning, and settled down to enjoy some exciting, if not fast, polo.

From the outset it was evident that the players were up against three formidable difficulties. Firstly, the tats' mouths; these were beyond redemption. Secondly, the animals' shoulders and necks which, comparatively speaking, were non-existent. Thirdly, the facetiousness and hilarity of the crowd. But it is an ill wind that blows nobody any good; the cheers, laughter and remarks of the spectators sufficed to drown the stream of bad language indulged in by certain players who shall be nameless.

During the first two chakkars of the first game, Captain Harness was not up to form. In the third chakkar Mr. Curbcheyne disappeared into the forest and down the khud. Five minutes later his pony returned minus bridle; and ten minutes after that, he himself turned up, red-faced and breathless.

Result: the Staff team wins, 5—2.

In the second game the play of both teams was marked by caution and restraint, despite the cries and counter-cries of partisan spectators. Nothing untoward occurred until the second half of the fourth chakkar, when Major



The East Enders' team.

Caesar Cogwheel galloped madly round the ground, clinging to his tat's belly. While he was being shaken off into a thorn bush, Bmbdr. Detonator —the visitors' No. 2—was thrown into the band. The band stopped. Mr. Piccolo, who had narrowly escaped being knocked down, did not join in the general merriment; indeed, he looked decidedly disgruntled. The Bmbdr. dislocated a thumb.

The odds were now equalised—but only momentarily. S.M. Roster's mount, a diminutive dun, bolted the full length of the ground. It pulled up suddenly, and of its own volition, when its saddle was sitting on top of its head and obstructing its view. The S.M. thereupon slid off—or fell off—involuntarily, and scored a goal on foot. The referee penalised this irregularity with a fifty-feet foul.

Result: the East Enders win, 2—1.

The final provided a magnificent struggle, in the course of which five spills took place. The M.O. achieved popularity by going over his tat's tail; a heavy "sitter" which was greeted with loud shouts of "Encore—encore!" However, this feat was entirely eclipsed by the provost-serjeant who pitched into a *mêlée* and received a resounding smack on the ribs from a mallet-head. The crowd roared with delight.

Result: the East Enders win, 4—0.

The trophy—a large, moth-eaten cabbage—was presented to the captain of the East Enders by the Honble. Charlotte.

We walked home from the Cinderella Dance.

A full moon made the firs black and the road white. We were all laughing and chattering until the visiting cleric said: "Well—it has been a jolly Week!"

"Yes," answered the Honble. Charlotte—"and do you know why?"

"I have my own ideas. What are yours?"

"A poet—Everest Lewin—wrote some lines about Time. We say he must have been born in Our Station; at any rate, it is from here he has been inspired."

"That is most interesting. Can you remember the lines?"

We halted, and a zephyr stirred the dry leaves into an accompaniment as the Honble. Charlotte repeated:—

The way of life is strewn with living dead
Whom he hath slain before they reach the grave.
Ere I succumb, one boon from Time I crave;
That I may live until he bows my head,
To work, to laugh, to suffer, and to strive:
Let me not fall among the dead-alive.

THE END.

Editorial.

BOVINE TUBERCULOSIS IN MAN.

A MEMORANDUM on "Bovine Tuberculosis in Man, with special reference to infection by milk" has been prepared by the Medical Department of the Ministry of Health, in response to a question in the House of Commons by Colonel Freemantle, M.P. for St. Albans. Colonel Freemantle asked the Minister of Health if he would issue for the guidance of the public a review of the main facts, experience and conclusions on which action should be based for the effective co-ordination of effort to prevent the spread of bovine tuberculosis from cattle to man, and to promote the consumption of milk.

In a short memorandum it was obviously impossible to give all the evidence supporting the various statements made, but special care has been taken to differentiate between the contentions, which are now generally admitted by all workers having special knowledge of the subject, and more doubtful points which are still the subject of controversy.

In order to understand the problems involved and the difficulty of obtaining accurate information as to the extent of bovine tuberculosis in man in this country, it is necessary to have some knowledge of the natural history of the infecting organism and its behaviour when introduced into the bodies of cattle and of human beings.

Some of the facts established by the Royal Commission on Tuberculosis and by Dr. H. H. Scott in his report to the Medical Research Council, on Tuberculosis in Man and Lower Animals, are re-stated. Tuberculosis in man and in animals is the same disease and the causative organisms resemble each other so closely that they must be regarded as varieties of the same species rather than as distinct organisms.

The distinction between the human and the bovine bacillus is made possible by the following facts: (1) The human bacillus grows more luxuriantly on certain media than the bovine bacillus, the addition of glycerine to the medium favouring the former and impeding or leaving unaffected the growth of the latter; and (2) the bovine strain is more virulent for bovines, pigs, rabbits, etc., than the human strain.

In spite of these differences there is now no doubt that man can be infected with the bovine as well as with the human type of bacillus, and that a considerable amount of tuberculosis in childhood is due to infection with the bovine type conveyed in milk from tuberculous cows.

The figures for notified cases of human tuberculosis do not give an exact estimate of the incidence of the disease as they do not take account of duplications and omissions. The memorandum contains two tables which give the incidence and mortality figures for human tuberculosis in England and Wales. From the table showing the incidence it is evident that there

has been a marked decrease in new cases. In 1913 there were 80,788 pulmonary and 36,351 non-pulmonary cases, while in 1929 there were only 57,274 pulmonary and 18,682 non-pulmonary cases.

As regards respiratory tuberculosis, there has been a general trend downwards of the death-rate for the last twenty years. In 1911 the deaths were 38,422, and in 1929 31,425.

The deaths from non-pulmonary forms of tuberculosis in 1929 were less than half of those for 1911.

It is difficult to estimate the number of cases due to infection of bovine origin. The possibility of bacilli of the bovine type being modified in the human body so as to manifest all the typical characters of the human bacillus is considered to be so remote as to be negligible for all practical purposes. The discovery of bacilli of the human or bovine type in any case of tuberculosis may be regarded as giving an accurate indication of the origin of the infection. Dr. A. S. Griffith's investigations seem to show that as much as half of the tuberculous disease of children under 15 years of age is due to the bovine bacillus. But he found very little evidence of bovine infection producing pulmonary tuberculosis in children. Out of 795 cases of pulmonary disease investigated there were no cases of bovine infection in children in the group from 0 to 5 years, none in the group from 5 to 15 years, and only 2·6 per cent at all ages.

An estimate of the incidence of tuberculous disease in cattle may be based on the results of the tuberculin test. This is not a quantitative test; it gives no indication of the degree of infection present. Heavily infected animals may not react to the test, but in such cases clinical manifestations are almost invariably present. An animal which reacts to the tuberculin test must be considered infected, as it is usually found that if it is allowed to live long enough it goes on to a condition of active progressive tuberculosis and becomes a cause of the spread of the disease in a herd.

The subcutaneous tuberculin test, which depends on a rise of temperature following on the hypodermic injection of a measured quantity of tuberculin, was found by the Tuberculin Committee of the Medical Research Council to be unsatisfactory under ordinary farm conditions and difficult of interpretation. The Committee recommended the double intradermal test, which has been made obligatory by the Ministry of Health and by the Department of Health for Scotland in the case of herds licensed for the production of certified milk and Grade A (T.T.) milk.

It is stated in the memorandum that any estimates of the incidence of tuberculous disease in cattle based upon the tuberculin test must be accepted with caution, as there is reason to believe that the incidence of the disease varies very considerably in different localities, and the reports available relate chiefly to milch cows, which are more prone to tuberculosis than young cattle or other bovine animals. Though the percentage of reactors in different investigations has varied within wide limits, it is

thought that 40 per cent would be accepted as an average figure for milch cows.

The results of slaughter-house examinations furnish some information on this point. In 1929, at the Metropolitan Cattle Market, Islington, 51 per cent of the cows slaughtered were found to be tuberculous. In Edinburgh, the corresponding figures in 1926 and 1927 were 46·5 per cent and 42·99 per cent respectively.

In 1921 McFadyean estimated that of breeding animals from 3 years upwards not less than 30 per cent were tuberculous, and that for the principal milking breeds the figure would probably be nearer 40 per cent. The Ministry consider these estimates as moderate—the real proportion is probably considerably higher. Not all these animals are yielding tuberculous milk, but as the disease is progressive they might be regarded as ultimate sources of such milk if they survive long enough.

The evidence now available makes it practically certain that tuberculous milk is the main vehicle of infection with bovine bacilli. We have seen that children are more often infected than adults, and a reason for this is that the alimentary defensive mechanism is less well developed in childhood, when large quantities of milk are taken, than in adults.

In these circumstances it is obviously of the first importance to have accurate information as to the prevalence of tuberculous disease of the udder. This is difficult to assess as it is often impossible to detect the disease clinically, and in the early stages tubercle bacilli may be present in the milk without any change in the appearance of the udder. Primary tuberculosis of the udder is extremely rare, and in fifty per cent of the cows found tuberculous on slaughter the disease was generalized in the body. From slaughter-house statistics and the results of inspections by veterinary surgeons it would appear that the incidence of tuberculous mastitis is about one per cent. McFadyean and Stockman both estimated the prevalence at 2 per cent; and Dewar gave it as over 1·2 per cent. The Ministry of Agriculture and Fisheries conclude that probably from 1 to 1·5 per cent of cows in herds in which the disease has been discovered under the operations of the Tuberculosis Order and the Milk and Dairies Acts yield tuberculous milk.

The proportion of tuberculous milk in any area will depend on the extent to which the milk is mixed before distribution and cannot be taken as an index of the proportion of tuberculous cows supplying the area. Bacteriological examinations of mixed milk samples give some idea of the frequency with which market milk is infected with the tubercle bacillus. Savage's examinations of the annual reports of Medical Officers of Health showed that in Liverpool out of 4,922 samples examined 7·1 per cent were tuberculous. In Birmingham 7·6 per cent and in Newcastle-on-Tyne 5·0 per cent of the samples were tuberculous. In Manchester during 1929, 1,133 samples of milk were examined for tubercle bacilli, of which 9·8 per cent gave positive results. The examination of

mixed milk samples from 697 country farms during the same period showed that 12 per cent of these farms were sending tuberculous milk into Manchester. The corresponding figure for London in 1929 was 7·5 per cent.

In the memorandum the methods of controlling infection are divided into two categories: those designed to check the infection at its source and those applicable to the milk immediately before distribution.

According to McFadyean the disease could be eradicated at its source in a few years by enforcing the general tuberculin testing of herds and slaughtering all reacting animals. Such a scheme has been carried out with complete success in Guernsey and in some States of the U.S.A. But in this country it would involve the slaughtering of one-third to one-half of the milking cattle and of a considerable proportion of the younger stock, require the payment of a huge sum of money for compensation, and would reduce the supply of milk for many years to come.

The Ministry of Health think that owing to the ambiguity of the tuberculin test and the presence of the disease in pigs and other animals constituting subsidiary sources of infection, reinfection would undoubtedly occur in a short time, and the scheme would not be so successful as McFadyean believed.

In view of the difficulties involved in such radical measures the Ministry of Agriculture and Fisheries issued the Tuberculosis Order of 1925, which aims at the destruction of every cow suffering from tuberculosis of the udder, and of every bovine animal suffering from tuberculous emaciation or suffering from a chronic cough and showing definite signs of tuberculosis.

Any person in charge of such animals must notify the Local Authority, who will order the animals to be examined by their veterinary inspector, and, if he considers the animals belong to any of the three groups, they are slaughtered and compensation paid to the owner.

The order has been criticized on the ground that the animals may not be notified until the disease has been in existence for a long time, and most of the harm has been done before they are destroyed. Moreover, as the farmer is compensated, however late the stage of disease when reported, there is no strong inducement for him to report early.

Bang's method of building up a tuberculosis-free herd from within depends on the fact that the calves of tuberculous cows are rarely born infected, and by removing them to clean premises and by strict vigilance preventing the access of infection to these animals. Watch is kept for the signs of infection in the healthy herd by half-yearly or more frequent tuberculin tests.

A considerable number of tuberculin-tested herds exist in this country, but the common practice of recruiting them from without renders it almost impossible to keep them free from tuberculosis. The only hope is by building up the herd from within and keeping it self-contained. A special investigation of this method is being made in a selected area in

Scotland by the Medical Research Council in conjunction with the Hannah Institute for Research in Dairying, Auchincruive, Ayr.

The possibility of controlling bovine tuberculosis by the administration of a live vaccine has been under consideration for some years; Calmette has suggested the use of what is now known as the B.C.G. (Bacille Calmette-Guérin) vaccine. By cultivating a bovine bacillus obtained from a cow on glycerinated bile-potato for some years, he obtained a strain of the tubercle bacillus of such low virulence as to be incapable itself of causing the disease, but still able to arouse an effective immunity response, even when given by the mouth. Since 1915 a number of experiments have been made with B.C.G. vaccine for the protection of cattle. Calmette claimed that it conferred a considerable degree of protection on calves, if given very early in their lives.

Dr. Stanley Griffith and Professor J. B. Buxton have been working on the immunization of cattle at Cambridge, and some of their recent work seems to show that B.C.G may confer protection on calves. Their experiments are, however, not yet complete.

The Medical Research Council's Committee dealing with the bacteriology of tuberculosis instructed Dr. Stanley Griffith to carry out experiments with B.C.G. on monkeys, because of their well-known susceptibility to tuberculosis. He confirmed the low virulence of B.C.G. and the possibility of its absorption from the alimentary tract after administration by the mouth, but he did not find any protection against subsequent tuberculous infection was conferred in any of his experiments.

The general consensus of opinion seems to be that Calmette has not finally established his claim to the satisfaction of most experienced workers in this field. As regards the protection of cattle by B.C.G., the results of Griffith and Buxton's work at Cambridge must be awaited before any decision on the practical value of the B.C.G. vaccine can be given.

The routine clinical examination of dairy cattle is a measure of considerable importance in checking the distribution of tuberculous milk. The Milk and Dairies (Scotland) Act, 1914, requires the inspection of cattle from time to time and at least once a year, and in a circular issued by the Department of Health for Scotland on March 7, 1930, it was suggested that a minimum of three inspections a year should be aimed at. Unfortunately the utility of this method of control is impaired by the frequent changes in the cow population.

The examination of milk for tubercle bacilli by microscopical and biological tests, especially when combined with a clinical examination by a competent veterinary surgeon, is of great value when applied to a mixed sample from several cows. If a complete list of the cows is taken, the infected animals can then be traced should the examination of the bulk sample give a positive result.

The education of the cowkeeper in matters of sanitation is of pressing importance. Although great improvements have been made in the stalling, care and milking of cows, much still remains to be done.

The scheme for grading milk established by the Milk and Dairies (Amendment) Act, 1922, and the Milk (Special Designations) Order, 1923, made under that Act, has so far achieved only a limited success. The quantity of milk produced under the designations, "Certified," Grade A (Tuberculin Tested), "Grade A," and "Pasteurized," is only a small fraction of the national supply.

The principal attack upon bovine tuberculosis should be made at its source before the milk is distributed. With this object in view, the Corporation of Manchester obtained a Local Act giving them powers for the control of milk produced outside the city. The milk clauses were subsequently incorporated in about 100 Local Acts in the country generally. The Local Acts were repealed and finally replaced in 1915 by the Milk and Dairies (Consolidation) Act. This Act gave the M.O.H. of a County or County Borough the power to prevent the sale in his area of milk which he believes is likely to produce tuberculosis. If the M.O.H. of a local authority suspects the milk sold in his area is likely to be the cause of tuberculosis he must endeavour to determine the sources of supply and report the facts to the M.O.H. of the County or County Borough in whose area the cows are kept. The County M.O.H. must have the cows inspected, and, if necessary, he can stop the sale of milk from the suspected herd.

Owing to the bulking of supplies by large companies it is very difficult to find out the particular farm from which the milk is obtained. In a recent case eighty-five farms were under suspicion of supplying tuberculous milk in connection with one sample. Another difficulty is the length of time which elapses between the selection of the sample and the ascertainment of the results of the inoculation experiments. During this period the constitution of the herd may have been altered, and it may be impossible to trace the cows which have been removed. Through these and other causes the Act of 1910 does not appear to have had much effect on the incidence of tuberculosis or the sale of tuberculous milk.

There is, however, one process which will ensure a maximum degree of protection to the consumer of milk, and that is pasteurization before distribution. The Milk (Special Designations) Order, 1923, requires that milk sold as "pasteurized" shall have been kept at a temperature of not less than 145° F. and not more than 150° F. for at least half an hour, and then immediately cooled to a temperature of not more than 55° F., the milk being heated once only and not otherwise treated by heat.

According to Dr. Hamill's recent experiments for the Ministry of Health, milk pasteurized at 145° F. for thirty minutes is not appreciably altered; there is a good separation of cream, a good "cream line." The albumin, soluble calcium and magnesium phosphates are unchanged, and there is only a slight effect upon the enzymes present in the milk. Vitamin C is the only one of the vitamins injuriously affected by pasteurization.

Clinical and other Notes.

FRACTURE OF THE SCAPHOID. A STUDY OF FORTY CASES.

By Major C. M. FINNY, O.B.E,
Royal Army Medical Corps.

If one opens a standard work on surgery of ten years ago, it is remarkable how small a space is given to fractures of the carpal scaphoid. One receives the impression that it is a comparatively rare fracture. This was doubtless due to the fact that X-rays were used less than they are now, and to the relatively mild symptoms sometimes evoked by such a fracture. Even to-day the matter is not entered into very fully, and the relative value of conservative or operative treatment appears to be based on personal opinion rather than on the results of following up cases.

I recently came across an American work of some size dealing entirely with fractures in the region of the wrist. The author certainly dealt with fractures of the scaphoid at considerable length, and his conclusion was that, except in a few cases, better results followed operative than conservative treatment.

Despite this view, he admitted that a good functional result was not to be expected for six months after operation. He quoted in support of his dislike of conservative treatment some statistics, collected in the German Army, which were as meagre as they were gloomy. I regret that foreign service prevents me from quoting the exact figures mentioned; but, as well as I remember, there were six cases treated without operation, of which none was ever fit for full duty and three were invalided.

Such results were a surprise, and it occurred to me that, before accepting them and making a practice of excising every fractured scaphoid that came under one's care, the matter should be further investigated. I was unable to find any other reports based on following up the after-histories of men who had sustained this fracture, so decided to try to collect a sufficiently large number of cases to justify drawing conclusions which might be of value.

The first difficulty encountered was the fact that patients who have sustained a fracture of the scaphoid are rarely admitted to hospital. The annual admission rate in the whole Army for the three years 1927-29 averaged only twenty-five. I therefore sought the aid of the X-ray department at the Cambridge Hospital, Aldershot, and Major J. H. Baird R.A.M.C., kindly gave me access to his records as well as other help.

The first point of interest in the investigation was the realization of how relatively common the fracture in question is. During the years

1925 to 1927 it was demonstrated in 102 patients—an average of thirty-four fresh cases per annum. Those years were selected because I hoped that they would be sufficiently recent to enable the cases to be followed up, and sufficiently distant for the results of the fractures to be stabilized.

All cases who were still in the Aldershot Command were sent for and examined. These proved to be few in number, and considerable difficulty was experienced in tracing the parts of the world to which the remainder had been moved. In the case of men who could be traced, their new M.O.s were written to and asked to furnish a report, and many of them were kind enough to supply the information. A questionnaire was finally sent to such men as had been transferred to the Reserve, asking for the presence or absence of disability in the wrist. From these various sources forty replies were received—a small number, but, it is hoped, large enough to be of some value.

Before dealing with the results of these cases, I should like to refer to the invaliding rate of the accident. During the years 1927-28-29, six men were invalided out of the Army as a result of this fracture—an average of two per annum. The fracture was found to occur in the Aldershot Command alone on an average 34 times per annum, so that in the whole Army there must be an annual average of about 130 cases. From this it emerges that in the British Army the invaliding rate from this cause is under two per cent, not an alarming figure. It is impossible to say how many cases have been operated upon, but in the Aldershot series of forty there was only one. I operated upon another myself, but it is too recent for the end-result to be included in this article.

The above facts would appear to show that this fracture does not as a rule result in serious permanent disability; but more detailed information as to results is available in those cases X-rayed in the Cambridge Hospital, of which the subsequent histories were obtained.

The results have been classified as follows :—

Perfect.—Where there is full range of movement, and no loss of power.

Good.—Where there is some decrease in range of movement—usually dorsiflexion—but no loss of power and the patient is unhampered in his normal occupations.

Fair.—Where, in addition to decreased range of movement, there is some pain or weakness in the limb, and the soldier's efficiency is slightly impaired.

Bad.—When the disability renders the patient unfit for service in the Army.

Under the above headings the forty cases can be classified as follows: Perfect 22, good 12, fair 5, bad 1.

The one case which was operated upon is not included in the above—it was a perfect result.

These seem gratifying results, and an attempt was made to correlate the nature of the injury with the end-result. This was not very satisfactory,

as in the older cases the films could not be traced or had perished, and reliance had to be placed on the brief notes in the X-ray register.

Reference to the nature as well as the site of the fracture was found in thirty cases, as follows :—

Description in X-ray register	Perfect	Good	Fair	Total
"Crack"	3			3
"No displacement"	7	4	1	12
"Good position"	5	5	3	13
"Bad position"	1			1
"Considerable displacement"	1			1
	17	9	4	30

In the great majority of the cases there was some form of simple transverse fracture. It is remarkable that the two in which the X-ray appearance was unsatisfactory had such good results. The first of them was operated upon, and the second was nine weeks in a splint.

This investigation appears to prove that in the majority of cases some form of conservative treatment gives satisfactory results. Unfortunately, information as to treatment was included in only twenty-eight replies, and some of the results are surprising.

Type of treatment	Perfect	Good	Fair	Bad	Total
No treatment	1	4	2	1	8
Massage	2	1	2		5
Bandage	1		1	1	3
Splint and massage	7	4	1		12
	11	9	6	2	28

Of the "bad" results, the first was not diagnosed till late, and was invalided. The second one was operated upon, with a subsequent perfect result.

The cases marked "No treatment" were those in which the fracture was not diagnosed at the time, but were X-rayed at a later date, either because the symptoms of the "sprain" seemed slow in clearing up, or for some subsequent injury to the wrist.

Though the above figures are too small to warrant any positive conclusions, they contain some points of interest. First, that good results may be found even when treatment is absent or superficial. The case with a perfect result but no treatment sustained the fracture in 1922 through the junctions between the ulnar and middle thirds of the bone. Despite examples like this, the results bear out the belief in the value of splinting. Of the sixteen cases in which splints were not employed, nine (fifty-six per cent) were good or perfect, whereas of the twelve cases which were treated by splints, eleven were good or perfect, and the remaining case fair.

With the above excellent results from conservative treatment, it at first sight seems difficult to understand why some authorities are in favour of operative treatment as a routine. The reason is probably a matter of

diagnosis. The symptoms of a simple fracture of the scaphoid may be little worse than a sprain, so that if the patient's work is not of a strenuous nature, he may carry on after a few days' rest. In the Army, however, most men's work is of a fairly heavy nature. Consequently the soldier usually takes the first opportunity of showing his wrist to a medical officer, who sends him to be X-rayed forthwith, or as soon as the persistence or recurrence of symptoms rouses his suspicions.

Further, in civil practice, though possibly the X-rays are not employed so freely on sprained wrists as in the Army, these cases are presumably dealt with successfully by the general practitioner in the majority of cases, and still fewer find their way into a civil than into a military hospital. It is probably only the severe or complicated case which is ever seen by the orthopædic surgeon. Such patients presumably have already been treated on conservative lines without success, and an operation may be the only treatment available. An orthopædic surgeon, therefore, is more likely to have a low opinion of conservative treatment than a general surgeon, who treats the straightforward as well as the complicated cases.

It is sometimes stated that unless bony union occurs, the distal fragment will die and form an aseptic but irritating foreign body. Also that the access of synovial fluid to the fracture site prevents such union.

In this series, eight of the forty cases showed union by bone. In six of these the position of the fragments was recorded, and in every case it was good, so that possibly the synovial membrane was not ruptured, and thus union occurred. In seven the results were recorded. These comprised two perfect, two good and three fair, results which compare unfavourably with the cases in which there is no record of osseous union having taken place. It would appear from this that bony union is by no means essential to a perfect result.

Treatment.—It has been shown above that the highest percentage of perfect results followed the use of splints; next came massage, so that the employment of some form of splint and massage is certainly indicated: but what type of splint, and for how long? In five of the perfect results the duration of splinting is recorded, and it averages over seven weeks. This certainly appears an unduly long time, but it shows that no harm can result from erring on the side of caution.

It is stated that dorsiflexion of the wrist tends to separate the fragments and so delay union; but as incomplete dorsiflexion is the commonest and often the only disability following this fracture, it seems reasonable to use a "cock-up" splint, provided the dorsiflexion can be gained without pain or force. Whatever type of splint is used, it should control the wrist, but not the fingers and thumb, and should be worn for three or four weeks in simple cases. If there is marked displacement, the duration of splinting should be doubled. It should be accompanied by massage without movement and followed by both.

Operation should be reserved for cases with marked displacement or

comminution and for those in which disability persists in spite of the above treatment. The removal of the whole bone is not an easy operation, and its benefit is unlikely to be apparent before the lapse of several months.

Conclusions.

(1) Fracture of the carpal scaphoid is a common injury.

(2) Treatment should be conservative, and the best results follow rest on a splint for three or more weeks.

(3) Though osseous union does occur, equally satisfactory results may be obtained in its absence.

(4) Operation should be reserved for special cases.

I wish to take this opportunity of thanking not only Major J. H. Baird for giving me access to his X-ray registers, but also the numerous medical officers in various parts of the world who assisted me by examining and sending me reports on the after-histories of cases, and in several cases recent radiograms as well.

MULTIPLE MYELOMATA.

BY BREVET LIEUTENANT-COLONEL R. C. PRIEST,
Royal Army Medical Corps.

It was in 1847 that MacIntyre invited Bence-Jones to report upon the urine of a patient suffering from an undiagnosed illness, and as a result of his examination a peculiar protein, Bence-Jones protein, was revealed.

The patient subsequently succumbed, and at the autopsy a condition of multiple myelomata was found.

In 1889, Kahler of Prague fully described the disease and noted the association of myelomata in the bony system with the unusual protein in the urine, and in consequence this clinical entity has been named Kahler's disease.

In 1900, T. R. Bradshaw reported another case which he called myelopathic albumosuria, at the same time quoting eleven previously reported cases. Later, in 1904, Parkes Weber reported a case and made reference to some forty cases which he had collected.

The disease in its typical form is characterized firstly by the presence of myelomata in the bone-marrow, the myelomatous tissue being either diffused throughout the marrow substance or forming localized swellings or tumours, and secondly by the presence in the urine of Bence-Jones protein.

The marrow of the affected bones is invaded by a diffuse pulp-like growth, and the compact bone becomes reduced to a thin shell; in some cases localized outgrowths from the bone may form, resulting in nodules or maybe large tumours covered with a thin bony shell.

The ribs, vertebræ and sternum are favourite sites, but other bones of the skeleton may be involved. The myelomatosis, as it has been called by some, remains limited to the osseous system, and even if a large tumour result, the neighbouring viscera are pressed upon or merely displaced, but are not invaded by the tumour. The bones become soft and friable, and spontaneous fractures have been reported many times; the spine may therefore exhibit marked kyphosis and the spinal cord may be compressed either by excessive angular deformity or by pressure from the growth itself.

The protein in the urine was considered by Bence-Jones to be a hydrated oxide of albumin, and it exhibits certain characters. The urine of patients with multiple myelomata is usually acid and, on voiding, may be clear, turbid, cloudy, or milk-white.

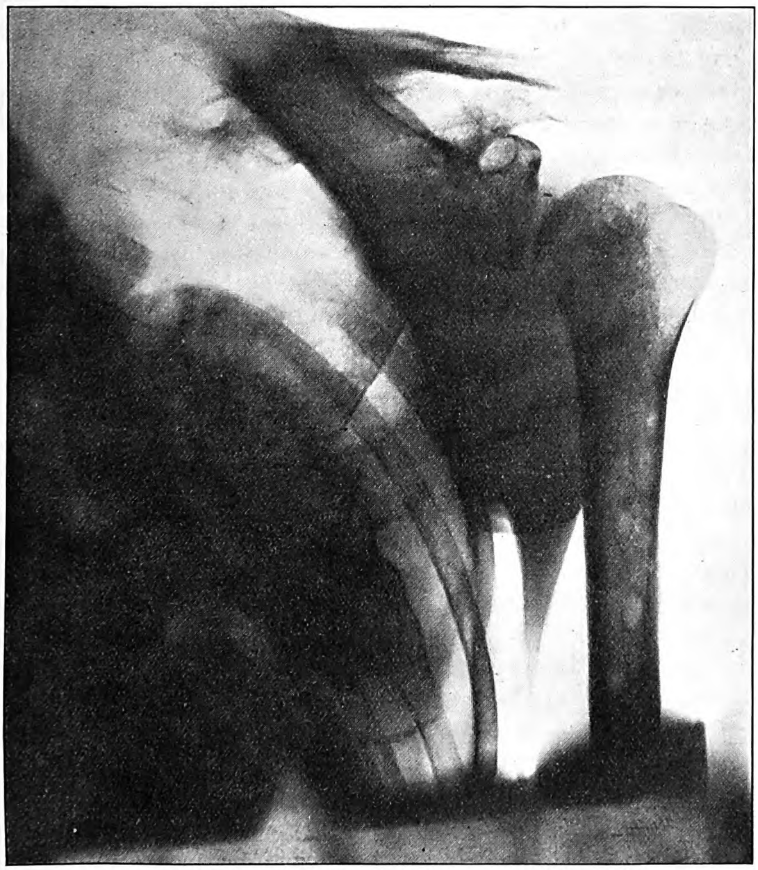
When the urine, without any addition of acid, is warmed, the protein coagulates at a temperature varying from 48° to 58° C., but if the urine is boiled the coagulum redissolves, only to reappear when the urine is allowed to cool. This protein is readily precipitated by hydrochloric and nitric acids, and unless the precipitate is made to redissolve by boiling, it may be mistaken for albumin. Similarly, the cloud produced by the addition of acetic acid will disappear and reappear. Lastly, if the urine is largely diluted and to it strong hydrochloric acid is added, the coagulum appears and behaves as above. The amount of this protein in the urine may be very large.

Metastases from malignant growths affecting the skeletal system do not provoke the formation and excretion of this protein. Myelomata may be present without Bence-Jones protein in the urine just as melanomata may be present without melanuria, and it is therefore conceivable that the presence of the protein in the urine depends upon the extent or amount of myelomatous tissue in the bone-marrow. Again, should the presence of the protein be discovered in the urine, it may be very difficult to prove the existence of myelomatous invasion, especially if this is diffuse in character. When, however, the disease has advanced far enough to cause the patient to complain of his symptoms, the urine will be found to contain the protein, and its presence in the urine is of sinister significance, denoting a slow downward trend, over a period of from one to four years usually, to a fatal termination.

Males are perhaps the more frequent unfortunates, and it is in the fourth decade that they commence to complain of their symptoms, which they ascribe to sciatica, neuralgia, lumbago, muscular rheumatism, and so forth. The disease may be brought to light by a sudden attack of lumbago, as reported recently by Macbeth Elliott, whose patient was a woman, aged 42.

All these insidious features are well exemplified in a patient, an officer aged 47, who was admitted in the summer of 1930 to the Queen Alexandra Military Hospital as an invalid from China. He said that he had been

suffering from persistent aches and pains which commenced some months previously, at first in both hips and thighs and later in the shoulders and arms. He thought movement and exercise tended to bring partial relief, but a rest after such exercises was apt to cause a feeling of stiffness in the joints. Sometimes, he continued, the constant ache in his thighs as far down as the knees, and in the arms as far as the elbows, transformed his life into an existence of burden and trial. His usual robust health had been



interrupted some years ago by an attack of left-sided pneumonia, from which he made a good recovery, but after a considerable time had passed he noticed that violent exercise caused some pain and discomfort in the left side of the chest which made him decide to give up such exercises. With this exception he has led an active life and had served in France and Gallipoli throughout the Great War without illness of any kind.

During the period of observation he exhibited a curious mentality which was ascribed eventually to the brave attempt to make light of and to suppress his actual and very real discomfort. Other patients in the ward had told him that he was in the habit of wandering about the ward during the

night, but of this proclivity he knew nothing, and he assigned his actions to the necessity of nocturnal micturition. He looked ill, care-worn and thin. With the exception of some fine crepitus on passive movement of the shoulder-joints, some impairment of percussion note and diminished air entry over the middle zone of the left side of the chest, clinical examination failed to bring to light any definite cause for the aches and pains in his limbs.

The urine immediately after micturition, however, was pale in colour, acid in reaction, sp. gr. 1018, and showed a milky cloudiness. There was a heavy cloud of protein, but no casts or red blood cells were seen in any of the specimens examined. This amount of protein led one to examine the renal functions in more detail. The blood-urea, blood-pressure, and urea concentration tests gave results which were within normal limits, and nothing of a pathological nature was seen in the optic fundi. Culture of the urine showed no growth of organisms. The blood examination revealed an anæmia of secondary type, the Wassermann reaction being negative. In an endeavour to explain the presence of such a quantity of protein without other support from laboratory findings of renal impairment, the possibility of the protein being of Bence-Jones nature crossed one's mind. The suspicion was confirmed.

In the meantime the chest had been X-rayed to determine whether there was any abnormality to account for, first, the pain which caused him to give up exercise, and secondly, in the slightly abnormal physical signs noted above. The X-ray showed a large myeloma arising from the left sixth rib, growing inwards and displacing but not invading the lung, and furthermore, the films taken of other bones displayed myelomata of varying sizes scattered throughout the bony system. After this discovery, the bony framework of the thorax was re-examined carefully for any evidence of outward deformity which might have been overlooked, but neither egg-shell crackling nor deformity could be noted. Moreover, the scapula, beneath which the myeloma seemed in the X-ray film to be situated, served as a cloak and hindrance to complete palpation of the thorax. Surgical operation was not advised, and eight lengthy exposures to deep rays made no alteration either in the size of the tumour or in the general condition of the patient.

Radiant heat, diathermy, massage, exposure to artificial sunlight and all internal remedies failed to arrest the steady downward course of the patient, who succumbed in April, 1931, some eighteen months from the time of first appearance of his subjective symptoms.

The print of the X-ray film shows well the distortion of the rib and the invasion of the medulla of the humerus by the myelomatous growth.

REFERENCES.

Bradshaw, T. R. *Brit. Med. Journ.*, 1900. ii, 1304.
Parkes Weber, F. *Journ. Path. and Bact.*, 1904, ix, 172.
Elliott, Macbeth. *Brit. Med. Journ.*, May 10, 1930, p. 852.

Echoes of the Past.

EVENTS IN INDIA, 1857-1858.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.
Royal Army Medical Corps.

(*Continued from p.* 147.)

Central India, 1858.

The situation in the Bombay Presidency had been firmly and skilfully handled. The Bombay sepoys as a whole remained loyal and did good service in the suppression of the rebellion. On December 18, 1857, a force of 6,000, consisting of European and Bombay troops with a part of the Hyderabad contingent, was assembled at Mhow,[1] with the general idea of the restoration of order in Central India. The campaign which followed, involving a long-sustained effort, a march of a thousand miles with constant fighting under the most distressing conditions of heat, fatigue and privation, is considered by Sir John Fortescue as the most remarkable achievement in the Indian Mutiny. Sir Hugh Rose, the commander, had no previous experience of Indian warfare, but he instilled new life into the operations. Transport, in which camels were largely employed, was reorganized. Baggage, though still excessive according to modern ideas, was much cut down. Attention was paid to clothing. The 3rd Bombay Fusiliers (2nd Leinsters) received a loose "stone-coloured" blouse and trousers and pagri of the same colour. The 71st, who joined in May, are described as wearing a loose khaki-coloured blouse and overalls, with a light shako-like hat provided with a heavily-padded curtain reaching behind nearly to the waist. A light red serge was introduced in 1859.

On January 6, Sir Hugh Rose marched out of Mhow, and, on the 28th, had occupied Saugor. Surgeon Lowe of the Madras Sappers and Miners, who wrote a history of the campaign, records an incident which occurred here showing how slow the old Indian army officers were to absorb new ideas. A sepoy was courtmartialled for alleged looting, and sentenced to be flogged and branded. A parade was ordered, and the Brigadier asked the medical officer in attendance if he had come prepared to carry out the second part of the sentence. The M.O. replied that the art and science of branding formed no part of his professional education, and proceeded to

---

[1] 14th Light Dragoons, 86th Foot, 3rd Bombay Europeans (2nd Leinsters), 6th Field Battery R.A., 21st Co. R.E., 3rd Bombay Cavalry, two batteries and one horse battery of the H.E.I.C., 25th Bombay Infantry, Madras and Bombay Sappers, detachment Hyderabad Contingent.

prove by regulations that it was no part of his duty. As no one else was competent to perform the operation, this part of the punishment had to be omitted.[1] On February 9 the rebel stronghold of Garhakot, twenty-five miles to the east, was captured, and on March 3 the territory of the Rajah of Shahghar was annexed to the Crown. There was a brush with the enemy on this date in the Madanpur Pass.

In his despatch referring to this engagement, Sir Hugh mentioned his staff surgeon, James Vaughan of the Bombay establishment, who, "on account of paucity of officers, gallantly led a party of Hyderabad Infantry who cleared a difficult position of the enemy." The area of operations included the great tableland of Malwa, a highly-cultivated country with rich, black soil varied with small conical and flat-topped hills and low ridges watered by many rivers draining into the Jumna on the north and the Narbada with its tributaries on the south. A large part was covered with forests, especially the hilly regions. On March 20 the force was within fifteen miles of Jhansi where, in June, 1857, sixty-six British of all ages and sexes had been massacred after evacuating on terms the post in which they had defended themselves.[2] The town, which was strongly fortified, was invested, and on April 1 an army under Tāntia Topi was successfully engaged and dispersed with a loss to ourselves of 17 killed and 63 wounded. On April 3, with a further loss of 42 killed and 211 wounded, Jhansi was stormed. There were three casualties among the medical officers; Surgeon Thomas Stack of the 86th was shot through the heart when accompanying the stormers, Assistant Surgeon Miller of the 3rd Europeans and J. Cruickshank of the R.E. were wounded. Surgeons F. S. Arnott and J. Vaughan, both of the Company's service, received mentions. A depot hospital was established here in charge of the Field Surgeon, who was left, with one assistant, in charge of 300 sick.

Owing to the increasing heat, marches could now only be performed at night. The dust was several inches thick on the roads, and the further the column went the scarcer became the water, which was now found only in small round wells at a great depth and was lukewarm and brackish. Many of the soldiers, who slept through the time the sun shone, never woke again and were found dead. The next important engagement was at Kunch on May 6. We had 9 killed and 47 wounded, but, in making the flank march to turn the position, there were 46 cases of sunstroke, 14 of them fatal. The temperature rose to 115° in the shade, there was a marvellous mirage, the flat plain appearing as a lake of water, trees and all figures

---

[1] Whether or not *branding* was ever carried out by medical officers, there was an order still in force about this period that *cupping*, if performed on a patient, should be done in such a way as to leave cross scars, thus affording a means of identification (Sir A. F. Bradshaw, C.J., vol. xl, p. 146).

[2] The men were tied in a long line between some trees and their heads struck off. The ladies who had children were compelled to see them cut in half before their turn came. Dr. McEgan of the 12th N.I. and his wife were among the victims.

acquiring gigantic proportions. "While the action was going on, dooly after dooly was brought into the field hospital with officers and men from the front, some dead, others prostrated, some laughing and sobbing in delirium. Eleven were thus killed outright. Four times had Sir Hugh Rose to dismount, unable to remain in the saddle under the blazing sun. From time to time his doctor poured water over him, gave him restoratives, and set him on his horse again."[1]

On the 10th Rose continued his march, being in constant touch with parties of the enemy, whose tactics were to disorganize and prostrate their opponents by continued exposure to the sun. The complete collapse of one of the two brigades necessitated a halt of three days. On May 21 he reached the vicinity of Kalpi, which the rebels held in strength, where he was joined by a camel corps made up of four companies of the Rifle Brigade, and the 88th, with the same number of Sikhs. On the following day the enemy was engaged, routed, and severely punished, our casualties being 24 killed and 43 wounded, with fully as many laid out by the sun. A detachment was sent in pursuit, but the limit of human endurance had been reached. Bundelkand and Rajputana had meantime been cleared by independent columns under Generals Whitlock and Roberts, and Rose's work appeared completed. The latter was himself in hospital with his fifth sunstroke, and his chief staff officer was raving in delirium. The troops halted, and the sick were sent into Cawnpore.

But there was still work to be done. Tantia Topi, after his defeat at Kalpi, with the Rani of Jhansi, made for Gwalior. Here Scindhia was loyal, but his army deserted him in the field, and the fortress was captured. On receipt of the news, Sir Hugh at once marched and, fighting two actions on the way, arrived before the city on June 19, which he took by assault. The battle casualties of the Central India Field Force between January 31 and May 22 amounted to 112 killed and 433 wounded. In the Gwalior campaign, June 6 to 19, there were 22 killed and 62 wounded.

By this time there were 96,000 British troops in India, and the medical staff had correspondingly increased. The Army List for 1857 shows, apart from the regimental surgeons, an Inspector of British Hospitals in Bengal and a Deputy Inspector in Bombay. In 1858 there appear a second Inspector in Calcutta, 11 Staff Surgeons, First Class, and 32 Second Class. Some of these became P.M.O.'s of independent columns.

After the capture of Lucknow the pacification of Oude and Rohilcund was proceeded with. Organized resistance came to an end in June, when opportunity was taken to afford the troops some respite from the heat. In an engagement fought by Sir Hope Grant at Nawabganj on June 13, his brigade of 3,500 had 67 battle casualties, in addition to which 33 were killed by the sun, and 250 went to hospital from the same cause.

[1] Whitton, "History of the Royal Canadians." The 71st, who had the eleven deaths, had just joined the force from Malta.

The following medical officers served with European regiments in Central India between January 1 and June 30, 1858 :—

8th Hussars, Surgeon A. P. Lockwood, Assistant Surgeons H. Sherlock,[1] T. Rudd; 12th Lancers, Surgeon A. Barclay (43rd), S.M.O. Saugor Field Force, Assistant Surgeons E. M. Wrench, S. Gibson, D. C. Wadsworth; 14th Light Dragoons, Surgeon Archibald Stewart,[1] Assistant Surgeons R. C. Lofthouse,[1] S. Skipton[1]; Royal Engineers, Assistant Surgeon A. Cruikshank (wounded); Royal Artillery, Assistant Surgeon T. J. Orton; 71st (1st Highland Light Infantry), Surgeon E. Wilson, Assistant Surgeons W. Simpson, W. Leach; 83rd (1st Royal Ulster Rifles), Assistant Surgeon H. C. Miles; 86th (2nd Royal Ulster Rifles), Surgeon T. Stack (killed), Assistant Surgeons T. S. Barry, C. H. Browne; 95th (2nd Sherwood Foresters), Surgeon John Ewing, Assistant Surgeon John Clarke[1]; 3rd Bombay Europeans (2nd Leinsters), Assistant Surgeons Miller (wounded) and Brown, Gwalior Contingent attached. Assistant Surgeons W. H. Harris and James Good (43rd) also served in this campaign.

The following medical officers of the Hon. East India Company's service were mentioned in despatches: Surgeon F. Arnott, superintending surgeon, and James Vaughan, staff surgeon, with Sir Hugh Rose's force, J. H. Orr, W. Mackenzie, D. Ritchie (field surgeon), J. Deas, G. Nayler, W. G. Davidson, superintending surgeon, and Macfarlane, field surgeon, Saugor Field Force, W. G. Bradley. Two medical officers, J. H. Sylvester and Thomas Lowe, wrote accounts of the campaign.

Colonel Neill has gone down to posterity as one of the greatest exponents of "the decisive force of offensive action" in dealing with natives, of which some of the other commanders during the Mutiny showed a noticeable absence of appreciation. A blind application of this principle without invincible determination to carry it through led others to disaster. In April, 1858, as the result of Sir Colin's operations in Oude, a rebel leader, Koer Singh, was driven in the direction of Arrah in the Patna district, which then held a small garrison of 150 men, H.M. 35th, 50 seamen and 150 of Rattray's Sikhs. Whereupon the officer in command determined to attack. Marching towards Jagdespur, the column entered the jungle, where it was ambushed by the concealed enemy. The men were full of confidence, and were already formed for a charge which might have saved the situation, when their leader hesitated, a bugle sounded the retire, and a general action continued for an hour during which the enemy was continually reinforced. Orders were then given to withdraw. One of those present wrote: "We began our retreat in a most orderly manner, till we reached a tank in the open plain where soldiers, sailors, Sikhs and followers began swallowing stagnant water, as they could get no better and were fainting with thirst, when a cry was raised that the cavalry was thundering

---

[1] These were mentioned in despatches.

down on us; but no one would rise till Dr. Clarke of the 35th, running forward, drew his sword and called on the men to form a square round him. A sort of one was formed and a volley discharged, which soon made the horsemen turn about. After this every man had his own way; no commands were listened to; the men were raving wild; the European portion of the force were falling from apoplexy by sections, and no aid could be administered, as the medical stores were captured and the dhooly-bearers had fled. There were sixteen elephants, but they carried the wounded, so they were left behind to be cut to pieces. Captain Le Grand was shot through the chest and died; Lieutenant Massey and poor Dr. Clarke, both of the 35th, fell from apoplexy and were left to the mercy of the enemy."[1] Out of 200 Europeans who started eighty reached home.

In the autumn of 1858 the Commander-in-Chief again took the field. The pursuit of Tantia Topi continued till April, 1859, when he was run to earth, brought to trial, and hanged.

There seems to have been no lack of appreciation, either on the part of the Government or of the public, of the conduct of the officers of the two Medical Services during the Mutiny. Lord Clyde, in his despatch dated at Lucknow, February 21, 1859, stated that the Medical Department, "being composed of officers belonging to the two services, has shone equally in the matters of general organization and of regimental arrangements. The Director-General, Dr. Forsyth, and the Inspector-General of Her Majesty's Hospitals, Dr. Linton, C.B., in Calcutta, have worked successfully to meet the general requirements made on them, and the staff and regimental officers have well maintained the credit of their noble profession and the reputation for self-sacrifice which belongs to the surgeons of Her Majesty's armies—a reputation which is maintained in the field on all occasions, as well as in the most trying circumstances of the hospital."

Several promotions to the rank of Deputy Inspector-General were made in December, 1858. The C.B. was bestowed on J. C. G. Tice, who had been Inspector of Hospitals in Rohilcund; F. W. Innes, who had been Havelock's Principal Medical Officer; John Fraser (Rifle Brigade), Principal Medical Officer to Sir Hope Grant in Oude; C. A. Gordon (10th), Senior Medical Officer to General Frank's force in the capture of Lucknow; J. G. Inglis (64th), and Joseph Jee, V.C. (78th). The officers of the Indian Medical Department who received the order were: Superintending Surgeon E. Tritton, for Delhi; J. C. Browne (Bengal H.A.), Colin Campbell's Superintending Surgeon in the operations at Lucknow, John Campbell, Ogilvie, and W. Brydon, of the garrison; F. S. Arnott, J. H. Orr, and W. Mackenzie, for Central India. Inspector-General William Linton received the K.C.B. in 1865 for his services as P.M.O., India. Inspector-General John McAndrew, retired in the second year of the Mutiny, also

[1] Charles Ball, "History of the Indian Mutiny." The medical officer referred to was Assistant Surgeon William G. Clarke.

received the K.C.B. and terminated his long and honourable career five years later.

The duties which the surgeons were called upon to perform, or assumed from a sense of duty, in these three strenuous years were many and various. Surgeon S. H. Batson, of the 74th N.I., one of the survivors of the European military population assembled on the Ridge, at Delhi, on May 11 1857, undertook to obtain help from Meerut. He disguised himself as a Mussalman, but was betrayed by the colour of his eyes. He was fired on, but escaped to a village, where he was stripped naked and robbed, reaching safety a month later after hiding in the jungle. At Patna Dr. R. Lyell, of the Company's service, was killed leading a party of police to restore order in the city. Dr. Watson, Civil Surgeon at Mynpurie, who with a few other officials remained after the senior civilian had fled, is mentioned as having done invaluable service in restoring confidence among the loyal natives and preserving the treasure. At the fight at Badli-ki-Serai Assistant Surgeon Whylock, of the 75th, was compelled to kill two of the enemy in order to save a soldier's life. Fayrer and Partridge formed part of the combatant garrison of one of the posts at Lucknow, and did some hard fighting. In the first relief, Assistant Surgeon McMaster, of the 90th, took over the colours and helped to lead an attack after the colour-party had been shot down; Surgeon Reade, of the 61st, was one of the first up the breach at Delhi, and spiked a gun. In a night attack by the rebels on the sanatorium of Mount Abu, Assistant Surgeon Edward Touch, 83rd, led his convalescent patients in a counter attack in which the enemy was driven down the hill. Assistant Surgeon J. J. Halls was one of the fifteen Europeans who with a detachment of Sikhs held out at Arah rather than desert their post. Surgeon Vaughan's assumption of military command in the Madenpur Pass is paralleled by the performance of J. T. C. Ross, an Indian cavalry surgeon, who was placed in command of a troop by Sir Hope Grant in the advance on Fateghar. Lord Roberts stated that he handled his command in the charge as well as any cavalry officer could have done.

Sir Colin Campbell, in his eulogy of the officers of the Covenanted Service, might well have added a word for the Subordinate Medical Department, to whose devotion to duty many officers bore witness. Sir A. D. Home, in his Reminiscences, mentions Mr. Hurst, of the I.S.M.D., who was instrumental in saving some of the helpless patients during Havelock's progress into Lucknow. Of the Indian sub-assistant surgeons on the Bengal establishment a large proportion were constrained to join the rebel army. Colonel Crawford, in his "History of the Indian Medical Service," mentions two by name, Chamman Lall, of the civil hospital at Delhi, a Christian, murdered by the mutineers, and Wazir Khan, teacher of materia medica in the Agra Medical School, who took a prominent part against us.

Whether any of the Medical Staff Corps who embarked for China in

1857 were diverted to India with the remainder of the troops is not clear, as there seems no account of their activities. In 1860 there were thirty-one in Bengal, but they all went home that year.[1]

There was severe fighting round Delhi, and the losses in Havelock's column at Lucknow amounted to seventeen per cent, but otherwise battle casualties on the whole were not heavy. The wastage from sickness was reckoned enormous by those to whom a hospital admission rate of 2,000 per 1,000 per annum was not unfamiliar.[2] In the A.M.D. report on the Tirah campaign of a later date, the Mutiny hospital admissions are stated in one year to have been three to one, and the death-rate just under nine per cent. According to the figures given, at least 5½ per cent of those engaged went to hospital with heat-stroke. Sir Colin Campbell was sparing of his men in action. It seems agreed that had greater enterprise been shown in pressing the rebels after their defeat at Lucknow, much of the mortality which resulted from heat-apoplexy, fever, and exhaustion in the long drawn out operations that resulted could have been avoided.

The deaths of 3 British Service medical officers in action have been mentioned. At least 4 others died of disease, the direct result of service. Of the Company's officers, 3 were killed in action, 9 at Cawnpore, 16 others were murdered or died in the jungle from exhaustion or exposure, 10 others died of disease.

While presenting a brief summary of the more important features of the Mutiny campaign so far as they affected the Medical Services, no attempt has been made to deal with the bewildering series of subsidiary operations, though they involved no less fortitude and devotion than the more spectacular ones. In many of these cholera, dysentery, fever and heat exhaustion proved as formidable adversaries as the rebel forces. That in these circumstances the medical officers as a whole succeeded in living up to the motto later adopted by the Corps there is every evidence to show.

---

[1] Colonel F. Smith, " Short History of the R.A.M.C."

[2] Some mortality figures can be gleaned from the regimental histories. The 78th, who were in Havelock's force, lost 217 men between July and December, 1857; of these 114 were killed and 103 died. The King's Regiment had 41 men killed at Delhi and lost 202 others, practically all from disease, during the campaign. The 2nd Rifle Brigade lost 132 from disease in twenty months, the 90th 312 all told, and the 79th 158. The 93rd lost 87 from wounds and 84 from sickness.

AN ANZAC DAY MARCH.

By Colonel S. F. CLARK.

April 25, the date on which the landing at Gallipoli took place in 1915, is observed as a public holiday in Australia, and the celebrations in Sydney include a march of ex-soldiers through the city to the Domain, where a great service is held in the presence of many thousands of persons. The troops who parade are, of course, mainly Australians, but any man who has served the King or the Allies by sea, land or air is welcomed. Uniform is worn by bands and colour parties only; all others, marching in sections of eight, are in mufti with medals and decorations. I have taken part in the last four of these marches. On the first occasion I took up an inconspicuous position with the British troops, but the next year, as nobody seemed to be in command of them, and as no pre-war officer was present, on my own initiative and supported by the request of others who recognized my seniority, I took command of all the British troops, exclusive of the Fellowship of Mons who marched as a separate body under their president.

In the next celebration (1930) I wrote to the Returned Sailors' and Soldiers' Imperial League of Australia, which manages the function, informed it of my action, gave my rank and corps, said that the British soldiers would prefer to be led by one of their own officers, with all respect to the Australians, and tendered my services if I could be of any use. My offer was accepted, so both last year and this year I was officially appointed to command the British, Dominion and Allied ex-soldiers, and walked at their head through the chief streets of Sydney to the Domain, which is an immense public park.

The march is an impressive sight. There are many bands, and the colours of the Australian battalions are carried, while the Imperial men (as the British are called here) follow a Union Jack. The column divides as it nears the flower-laden city Cenotaph, and passes it on each side four abreast, with bared heads and eyes right or left as required in salute. This is the supreme moment of the march. The bands and the crowd are silent, no words of command are given for the salute, and the bared heads give evidence that the men are ageing. After this homage to the dead, the original formation is resumed.

The streets are lined by the populace, and the British men are acclaimed all along the route. In fact, theirs is almost the only body which elicits any demonstration from the crowds—presumably every British-born soul present gives vent to his or her feelings—and as they march into the Domain at the end of the procession, the Australian troops in position, whom they pass, join in the applause.

It is probably a unique event for one of our officers to lead former British soldiers of all arms through the streets of a great city, and I feel the honour very keenly. This year unusually great interest was taken in

the march by the fact that Air Vice-Marshal Sir Philip Game, the Governor of the State of New South Wales, had announced his intention of joining in it. He declined to walk in front with the Headquarters Staff, but said that he would fall in with the British ex-soldiers. All the troops assembled in the grounds of Government House, and I was instructed to call for Sir Philip at the proper moment. I did so, and of course asked him to take the command, which he declined ; so he, his private secretary (General Anderson) and I walked together at the head of our men. About 10,000 Australian and New Zealand troops preceded us, and we were followed by some 70 of the Mons Fellowship, 350 other British soldiers, and 40 Canadians. No Allies appeared on parade, but last year a few Russians attended.

As the Governor passed along he received an ovation from the crowds in the streets, and many people could be seen pointing him out to their children. The women were the most enthusiastic; one excited lady, who was evidently thinking of the communistic element here, with eager face and flashing eyes, repeatedly shouted "Come on, you soldiers," as our formation went by.

A number of veterans, many of them wearing the Egyptian medals of nearly fifty years ago, marched as a separate unit apart from us, but our ranks showed decorations from Victoria Crosses downwards, and the medals of many campaigns.

The service was impressive, and at its close all troops were dismissed.

Current Literature.

WHITTINGHAM, H. E., KILPATRICK, J. M., GRIFFITHS, E. W. B. **A Cerebrospinal Fever Outbreak in the Royal Air Force in 1931.** *The British Medical Journal*, 1931, i, 1101.

The writers, officers of the Royal Air Force, describe an outbreak of twelve cases of cerebrospinal meningitis at the Royal Air Force Depot at Uxbridge. The first patient had been found to be a meningococcus carrier in May, 1930, and two months later was considered to be free from infection. Type I meningococcus was found in his carrier state and also when he was a sufferer from the disease, there was, however, no evidence to show that he caused the outbreak as the disease had been prevalent in the civil population for three months.

In the depot beds were spaced at intervals of two and a half to three feet, and the windows were kept open night and day. There were twenty to twenty-five men in each barrack-room and the rooms were heated by open fires at either end of the rooms. The men sat round these fires at night, and it is noted that all but one of the cases were in men whose beds

were near the fire-places, and the writers consider that the habit of crowding round the fires helped in spreading the infection.

In the centrally-heated barracks at Halton they found a carrier rate of three per cent in the seventh week of 1931, while at Uxbridge with open fires the rate at that time was fifteen per cent.

When the first cases occurred the carrier rate at Uxbridge was ten per cent. All common meeting places, except the dining hall and the canteen, were closed, but the carrier rate rose to thirty-two per cent in the middle of February; the canteen was then closed and the carrier rate dropped to five per cent in a fortnight. One hundred and twenty carriers were detected of whom forty-five were close contacts of cases. One carrier had been intermittently positive for ten months.

The patients were mostly newly-joined recruits, the average age being 19 years and 9 months, and the average service ten weeks. Four had a history of influenza beginning five to ten days before the disease appeared.

So far as could be ascertained the meningococcus present was Type I. Descriptions of various types of cases are given.

The mortality-rate was fifty per cent. The treatment employed was withdrawal of cerebrospinal fluid, flushing the subarachnoid space with normal saline solution and the introduction of antimeningococcus serum. This treatment was carried out twice a day for the first five days and once daily for five days more. Also calcium lactate was given to help to prevent serum sickness, and contramine was injected in patients in whom serum rashes developed.

With a view to controlling the disease extensive search was made for carriers and, when discovered, these were at once isolated. In all the barrack-rooms the space between beds was increased to four feet and the men were made to sleep alternately head and feet to the wall.

At first all the men were subjected to zinc sulphate inhalation by means of the Levick steam spray, but, as this took a considerable time, and as the crowding of men in the inhalation room was considered to be dangerous, spraying was replaced by nasal douching and gargling with either potassium permanganate solution or a solution of soda bicarbonate, borax, carbolic acid and sugar, and in addition a chlorine gargle was used. After the sixth spray treatment the writers found meningococci in thirty-two per cent of the men, which was the highest carrier rate found during the outbreak. They suggest that this indicates that meningococci in the nasal sinuses were discharged by the coryza induced by the spraying. The systematic gargling was considered to be efficacious in removing meningococci from carriers. Seventy-five per cent of the carriers were found to be free from meningococci in one month and the remaining twenty-five per cent in six weeks. Contact carriers were placed in isolation blocks at Halton where their beds were well spaced out and where they were exercised in the open air and made to gargle three times daily.

Ball, W. Girling. **Metastatic Staphylococcal Prostatic Abscess.** *British Journal of Urology*. 1931. No. 2, p. 172.

Two cases of this condition are reported.

The first patient was a medical student, aged 24, suffering from boils of the neck and buttocks, and who had a septic finger a week before the urinary symptoms developed. Seven days before the writer saw him, painful, difficult micturition suddenly developed, with throbbing perineal pain. The temperature varied between 100° and 103° F. The urine was normal. Rectal examination showed a large, smooth, fluctuating prostate, very painful to the touch. There was no urethritis and no stricture. On four successive days the leucocyte count was between 8,000 and 9,000. The prostatic abscess was opened by perineal incision, and about two ounces of pus escaped and a pure culture of *Staphylococcus pyogenes aureus* was obtained. Healing was complete in seventeen days. The urine was never affected.

The second patient was a man, aged 61, who had a boil on the scalp, and two days later there was a rigor followed by frequency and pain on micturition. He saw a doctor who found pus in the urine, and *S. pyogenes aureus* was isolated and a vaccine prepared. He went to the country, and had to consult another doctor for pain and frequency of micturition. He was put to bed and a dose of vaccine was given, with general treatment. In eleven days he was better and active, but in a day or two a boil appeared on a buttock, followed by difficulty of micturition, and, finally, retention of urine, for which a catheter was passed three times. Catheterization had to be stopped on account of the pain it caused. A cystoscope was passed and signs of cystitis, but no trabeculation, were seen. Urine was collected and a pure culture of *S. pyogenes aureus* was isolated. Ball saw the patient and found the prostate only slightly enlarged but hard, and he suspected a malignant condition. As the patient was very ill the bladder was drained suprapubically. Improvement ensued, but fourteen days later the evening temperature was still 99° to 100° F., and the left side of the prostate was then found to be bigger than the right, very tender and soft. There was some pain at the tip of the penis. The urine had become clear but still contained the staphylococcus. Two days later the prostatic swelling was much greater, and had extended to the right side, and the diagnosis of abscess was made. The abscess was drained by perineal incision. The suprapubic drain was removed. The wounds healed well. *S. pyogenes aureus* was isolated from the abscess pus.

Abrahmson, L. **Subacute Bacterial Endocarditis Following Removal of Septic Foci.** *British Medical Journal*, 1931, ii, 8.

Three cases are described.

The first patient was a man, aged 39 years, who, twelve years previously had been found to have well-compensated mitral regurgitation. In January, 1925, eleven teeth were extracted, first five, and a week later six. Soon

afterwards, small red spots appeared on the fingers, and about three months later, there was a sudden loss of power of the right arm and leg, but no loss of consciousness. He was seen by the writer about two months later, by which time the limbs had recovered, but petechiæ were present on the fingers. The evening temperature varied from 99·4° to 101° F., and the pulse from 90 to 120.

Blood-culture showed the presence of *Streptococcus viridans.* A little later, painful nodules appeared on a finger, on the right arm, and on the right buttock, also crops of petechiæ in various places. Next, sudden pain lasting for two days came on in the right shoulder, followed by petechiæ in this area. In September, sudden pain developed in the back of the head, and the patient died in a few hours.

The second patient had a history of rheumatic fever when a child, but he led a very active life and was astonished when, at the age of 21, he was rejected for the Army. He consulted a cardiologist who verified the heart condition and advised the removal of the tonsils, which he said were septic. Pyrexia came on after the operation, and pain and swelling in various joints. The writer saw him six weeks later, and found the throat to be still in a septic condition; temperature 102° F., pulse 120, and there were petechial spots on the legs. The heart was moderately enlarged, and there was aortic and mitral regurgitation. There was pallor and sweating. A pure culture of *Streptococcus viridans* was obtained on blood-culture. Remissions and exacerbations followed, and the patient died in seven months from cerebral embolism.

The third patient was a male, aged 53 years, who for two years had had attacks of auricular fibrillation and a systolic murmur, loudest in the mitral area, had been found. The teeth were at first sound, but, two months before the writer saw him, three teeth had been removed on account of pyorrhœa. First, two teeth were extracted easily, then the third, with difficulty, and with the injection of novocain. Bleeding continued for three days after the extraction of the third tooth, then a generalized purpuric eruption appeared with the hæmaturia, and bleeding from the gums and palate. Administration of hæmostatic and anti-streptococcal serum was followed by cessation of the bleeding; however, a few days later there was bleeding from the stomach and bowel. Blood-culture gave a negative result. The patient improved for about six weeks and was then able to go for a drive. He then relapsed, hæmaturia again appeared, also purpuric spots, followed by paralysis of the left arm, then of the left leg and left side of the face. There was some hæmatemesis, and the patient sank into a coma and died.

The writer, in commenting on these cases, says they show the necessity for extreme caution in the removal of septic foci, such as teeth and tonsils, in patients with heart lesions, although they indicate the necessity for the removal of such foci. In these patients, few teeth should be removed at one time; if extraction is difficult they should be left alone, unless there is

a definite abscess. The teeth of such patients should be very carefully looked after, and he deprecates the crowning of teeth and the preservation of dead teeth in such cases.

Reviews.

PYE'S SURGICAL HANDICRAFT. Tenth Edition. Edited by H. W. Carson, F.R.C.S.(Eng.). Bristol: John Wright and Sons, Ltd. 1931. Pp. xviii + 641. Price 21s.

This book has been revised, brought up to date and some new matter added. Originally written as an aid for house surgeons, it contains much useful information on minor surgical operations and treatment. Those of us who are only occasionally called upon to treat surgical cases will find the book most useful: details of solutions and technique used in the tannic acid treatment of burns, injection treatment of varicose veins and preparation of Dakin's solution are among those which we have needed. The injection treatment of hæmorrhoids and the preparation of Sinclair's glue are, however, not included.

The book might well be added to our small but necessary travelling library.

PRACTICAL ANÆSTHETICS. By Charles F. Hadfield, M.B.E., M.A., M.D.Camb. Second Edition. London: Baillière, Tindall and Cox. 1931. Size 5¼ in. × 8 in. Pp. xiv + 336, with 41 figures. Price 7s. 6d. net.

It is a pleasure to welcome a second edition of this book. Owing to the inclusion of the latest methods, the volume has had to be considerably enlarged, but it is still a most convenient size. It contains a vast amount of practical information and helpful suggestions on all forms of anæsthesia and a special chapter on local analgesia in dental practice.

The book commences with a very interesting chapter on the history of anæsthesia, but the chapter on "avertin" anæsthesia is disappointing.

The illustrations are good, but might be more fully explained.

The book is attractively written, well printed, moderate in price, and should be of great use to the general practitioner and the casual anæsthetist.

A MANUAL OF TUBERCULOSIS FOR NURSES. By E. Ashworth Underwood, M.A., B.Sc., M.B., Ch.B., D.P.H. Edinburgh: E. and S. Livingstone. 1931. Pp. vii + 272. Price 6s. 6d. net.

Those of the nursing profession who desire to specialize in the nursing and management of tuberculosis cases will find this little book attractive to read and invaluable in its help.

To those who wish to become specially trained and who propose

working for the Certificate of the Tuberculosis Association, this work can be recommended with confidence. Doctor Underwood has filled a gap by producing a book which contains all that a nurse should know upon the subject of tuberculosis, such as its nature, symptoms and signs, types of the disease in adults and children, the uses of tuberculin, light therapy, details of sanatorium treatment, and the functions of the tuberculosis dispensaries. His description of methods and procedures is lucid, and the subject matter is expressed in language freed as far as possible from technical terms. The reader will find a glossary at the end of the text explaining those technical terms which the author found necessary to employ.

There are thirty illustrations showing X-ray appearances, apparatus, splints and lamps, which are well produced. The book contains some 260 pages, is of convenient size, printed in large, clear type, and at the end a sufficient index brings a very useful work to a close.

A Study of the Strategy and Tactics of the Mesopotamia Campaign, 1914-1918, with Special Reference to General Maude's Operations. With thirteen maps. London: Sir Isaac Pitman and Sons, Ltd. 1930. Pp. xxi + 171. Price 5s. net.

In a handy paper-covered volume Sir Isaac Pitman and Sons offer an introduction to their military postal courses. These courses are intended not only to help officers in their promotion examinations but also to aid them in preparing for the Staff College. The work is a model of clear condensation and shows every evidence of the thought and consideration which must have been spent on it. The strategical lessons of this unique campaign are well shown and the enormous administrative difficulties which had to be contended with are prominently brought out.

The construction of the book is somewhat unusual. First comes a summary and then follows a detailed account of each year's happenings. Then follows a chapter showing how the campaign illustrates the principles of war, and then a bibliography and very clear and excellent maps.

We have nothing but praise for this book and are sure that it will help in the study of this campaign, which is so full of lessons for all arms of the Service.

A. C. H. G.

Health at the Gateway: Problems and International Obligations of a Seaport City. By E. W. Hope, O.B.E., M.D., D.Sc., Professor of Public Health, University of Liverpool. London: Cambridge University Press. 1931. Pp. xiv + 213. Price 15s. net.

The advancement of the health and welfare of the people is now so rightly regarded as the one thing that matters, that a book which tells the story of how various measures found necessary to promote this advancement came into being is sure to be widely read. Professor Hope tells the

story well of how the administration of the health services of the great municipality of Liverpool gradually developed; how measures were put in hand, some carried to fulfilment with lasting benefit, some abandoned as useless, others delayed, while evils grew by lengthened toleration.

Sir George Buchanan has written an interesting foreword and stamped the work as one of importance. Its 200 pages are divided into twelve chapters and are well arranged. First comes the subject of Port Administration and the author tells us how protection against avoidable disease is now secured, so that the introduction of, say, plague into a well managed British maritime town has no serious significance so far as the health of the community is concerned. The next chapter tells of the earlier condition and growth of the city of Liverpool, and Chapter III of the efforts made towards its social improvement. Chapter IV gives details of certain specific measures adopted against different forms of infection and then follows a chapter on the various administrative developments, such as district nursing, health visitors, welfare of mothers and children, etc. A detailed study of the city water supply and how it gradually attained to its present perfection then follows. Further chapters deal with the supervision of dwellings, housing operations, municipal cleanliness and the control of food supplies. The book ends with an interesting chapter on the general effects of public health legislation.

This is not merely a book for medical officers of health and medical men, for whom of course it will have a special interest, but one which should be read by administrators, Members of Parliament, and all who think seriously of their country's welfare.

A. C. H. G.

EPIDEMIOLOGICAL ESSAYS. By F. G. Crookshank, M.D., F.R.C.P. London: Kegan Paul, Trench, Trübner and Co., Ltd. 1930. Pp. ix + 136. Price 7s. 6d. net.

Although these essays have already appeared in various medical journals, Dr. Crookshank has now wisely brought them together in book form. They are worth careful reading, and though they cover a wide field they go very well together. A point the author makes throughout is that if we wish to progress in our medical knowledge we must get back to Hippocrates and the sooner the better. His empirical observations and few yet simple synthetic generalizations and deductions remain, and must ever remain, the foundation of all true medicine. There is no quackery to-day more dangerous than the verbal quackery which, flourishing as luxuriantly in Harley Street as at any spa, allows us to pretend that we are nearer the ultimate understanding of life, death and disease than was Hippocrates. Laboratory theorists who declare that only in a laboratory can experience be gained are also justly criticized.

Epidemiology, the science of disease amongst communities, is now, says the author, being reduced to an affair of mouse-traps. The laboratory *by itself* is bound to fail.

Of the ten essays, I liked "Airs, Waters and Places" the best. "The Treatment of Encephalitis Lethargica" seemed to me to be most illuminating and is a powerful plea against the common idea that all that can be done is to "proceed on general principles." The last of the essays styled "The Mortality of Pneumonia" drives home the author's teaching; it is a sad tale and is not exaggerated.

A. C. H. G.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LIST OF BOOKS RECEIVED DURING THE PERIOD APRIL 1 TO JUNE 30, 1931.

Authors	Title of Work	Grant or Gift
Patton & Evans ..	Insects, Ticks, Mites and Venomous Animals. Part III. Public Health	Grant
Crookshank	Individual Diagnosis	Library and Journal Committee
Blacklock	Report on a Survey of Human Diseases in the Protectorate of Sierra Leone	,, ,, ,, ,,
Wellcome Foundation, Ltd.	Souvenir Cinchona Tercentenary Celebration and Exhibition	,, ,, ,, ,,
War Office	Memoranda on Medical Diseases in Tropical and Sub-Tropical Areas, 1930	Commandant's Office
U.S.A. Surgeon General's Dept.	Index Catalogue of Library of the Surgeon General of the U.S A. Army. Vol. IX, 3rd Series	Surgeon General's Office
Medical Research Council	A System of Bacteriology. Vol. VIII ..	Grant
Mitchell	The Scientific Detective and the Expert Witness	,,
Hope..	Health at the Gateway	,,
Barnard. (Sherren) ..	Contributions to Abdominal Surgery ..	,,
Piersol. (Huber) ..	Human Anatomy..	,,
Cooper & Barber, &c. ..	Nutrition in Health and Disease	,,
Hill	The Complete Law of Housing	,,
League of Nations ..	Silicosis Records of the International Conference held at Johannesburg	,,
Waterson	Anatomy in the Living Model	,,
Hall	Textbook of Quantitative Analysis	,,
Treadwell & Hall ..	Analytical Chemistry. Vol I, Qualitative. Vol. II, Quantitative	,,
Spencer & Cade ..	Diseases of the Tongue	,,
Nicholson	Laboratory Medicine	,,
Stubbs & Bligh ..	Sixty Centuries of Health and Physick ..	,,
Bourne	An Introduction to Medical History and Case-Taking	Lt.-Col. R. C. Priest
Watson	A Handbook for Nurses	,, ,, ,,
Underwood	A Manual of Tuberculosis for Nurses ..	,, ,, ,,
Rose	Physical Diagnosis	,, ,, ,,
Halliburton, &c, ..	The Essentials of Chemical Physiology ..	Grant
Hadfield	Practical Anæsthetics	,,
Bennett	The Practical Treatment of Diabetes ..	Constable & Co., Publishers
Leitch & Watson ..	Beri-Beri and the Freetown Prison.. ..	Grant
General Medical Council	The Medical Register for 1931	,,
Pickett-Thomson ..	Annals of the Research Laboratory. Vols. III, IV, V	,,

Correspondence.

NOT ACCORDING TO THE NOMENCLATURE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Some time ago, having occasion to consult the Register of Deaths in an Indian cantonment, the following entries were found in the column "cause of death" with an occasional remark in the appropriate space.

	Cause of death	Remarks
1.	MOTIONS	On account of motions.
2.	PHENOMENA	Being sick three days.
3.	MISSION	,, ,, six months.
4.	PHENOMENA	,, ,, one month.
5.	THYSIS	,, ,, one month.
6.	WANT OF MILK	Age 8 days
7.	DEAD BORN	—
8.	RESPIRATORIES	—

No. 5 is evidently phonetic spelling. No. 1 might have been cholera; but was No. 3 religious mania and were 2 and 4 also mental cases?

I am, etc.,

A. E. S. PRINGLE-PATTISON.

Major, R.A.M.C.

Multan,
July 1, 1931.

Notices.

POST-GRADUATE COURSES IN VIENNA.

THE forty-second Post-Graduate Course of the Vienna Medical School will be held from September 28 till October 10, 1931, when subjects of general and special medical and surgical interest will be dealt with.

The course is described as being on important medical questions of the day, with special attention to treatment.

The fee is fifty schellings (approximately £1 10s.), and reductions in railway fares (50 per cent) in Austria, hotel charges, etc., are granted to members of the course.

On the completion of the general course a considerable number of special courses are available.

A similar general course will be held from September 26 till October 8, 1932.

Full information on the various courses may be obtained from the Secretary of the International Post-Graduate Course, Vienna, Dr. A. Kronfeld, Wien, IX, Porcellangasse, 22.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C. 2.

VOL. LVII | OCTOBER 1931. | No. 4.

Journal
of the
Royal Army Medical Corps.

Original Communications.

NOTES ON THE PROTEUS GROUP OF ORGANISMS WITH SPECIAL REFERENCE TO A CASE OF RENAL INFECTION BY A MEMBER OF THIS GROUP.

BY CAPTAIN G. T. L. ARCHER,
Royal Army Medical Corps.

THE case from which the organism described hereafter was isolated had certain points of interest.

The patient, an officer's wife, aged 25, became suddenly acutely ill. The case simulated fairly closely appendicitis, though the pain commenced in the right lumbar region. *B. proteus* was isolated from a catheter specimen of urine. The condition did not respond to medicinal treatment and a nephrotomy had to be performed, *B. proteus* being isolated in pure culture from the material evacuated.

Following the nephrotomy the patient had an attack of benign tertian malaria though she had never had malaria before. She had at this time been in Wellington (her first station in India, and one which is almost entirely non-malarious) about two months. She had previously been in Cyprus and China.

Thus her case appears to bear out remarkably well the statement in the "Memoranda on Medical Diseases in Tropical and Sub-tropical Areas 1930," that "an operation often lights up a latent malaria and the disease may appear after operation with fatal result."

BACTERIOLOGY.

Park and Williams[1] state that "The *proteus vulgaris* appears to be next

[1] Park, W. H., and Williams A. W., 1929, "Pathogenic Micro-organisms," p. 451. London : Ballière, Tindall and Cox.

in importance to the colon group in the ætiology of cystitis and pyelonephritis."

The bacteriological investigation is, therefore, of interest both on account of the organism isolated, and on account of the interpretation of its rôle in this particular case.

To consider the latter question first.

The proteus group of organisms is generally recognized as being of a very low degree of pathogenicity. So it is extremely improbable that it could be the primary cause of a septic process. Furthermore, almost all cases of pyelitis, pyonephrosis, pyelonephritis, etc., have their primary origin in either renal calculus or cystitis.

In this case, however, convincing evidence as to the primary condition is lacking.

There was neither blood nor pus in the earlier specimens of urine examined, and no history of painful micturition, though slightly increased frequency was noted; later, small quantities of pus were seen in the urine, but certainly no definite signs of either calculus or cystitis.

In the catheter specimen of urine examined on February 3, 1931, cocci grew in small numbers both on plates of litmus lactose agar made direct from the urine and on plates subsequently inoculated from a broth culture of the urine. The cocci were outnumbered on all plates by proteus colonies by about 100 to 1, but this may not represent anything like a true ratio of occurrence as the litmus lactose agar would tend to inhibit the growth of cocci while offering no resistance to the development of *B. proteus*.

No cocci were isolated from the material evacuated from the perirenal tissue at operation.

One is therefore left to choose between three possibilities :—

(1) Original renal calculus with very few symptoms.

(2) Hæmatogenous infection of the urinary passages with cocci, followed by secondary infection with *B. proteus*.

(3) Primary infection with *B. proteus*.

Of these solutions No. 1 seems the most likely.

The Organism.

On February 3, 1931, a catheter specimen of urine was taken ; a sample was put up in broth and another plated direct on to litmus lactose agar. In both cases rapid growth occurred in twenty-four hours. The growth on the plate consisted of a considerable number of colonies. The broth was subcultured on to litmus lactose agar plates, and in all plates the growth consisted of large non-lactose fermenting colonies with a later development of a scanty growth of cocci.

The original broth culture was put up against the patient's serum and was agglutinated to 1/250.

Later pure strains on agar slopes were emulsified in saline and put up against the patient's serum, the titre now being 1/5,000. Pure broth

cultures from the original plate culture were still only agglutinated to 1/250.

Examination of the patient's serum gave the following results :—

Organism	Titre or S.A.U.
B. typhosus	39 S.A.U.
B. paratyphosus A.	50 ,,
B. melitensis	100 ,,
B. paramelitensis	0
B. abortus	0
B. Gaertner	0
aertrycke Mutton	0
aertrycke Newport	0
Salmonella Brown	0
Salmonella Kyang Lup.	1/50 dilution
B. asiaticus	1/50 ,,

Biological Reactions of Isolated Organism.

Motility	Grams stain	Lactose	Glucose	Mannite	Saccharose	Maltose	Indol	Milk
+	–	–	A.G.	–	–	–	–	A. (later alk.)

Three days later one tube (of various sets put up) showed weak fermentation of saccharose and two tubes weak fermentation of lactose.

The question of its identity with *B. morgan* No. 1 was considered, and in spite of its urinary origin and failure to produce indol this seemed likely, since, although indol is usually formed by *B. morgan*, and indol formation was stressed as a characteristic by Morgan himself, it is not invariable.

It was decided, however, to plate the organism on gelatine. Liquefaction occurred, and the organism was thus definitely placed outside the coli-typhoid group of organisms and in the proteus group.

The same organism was isolated from an ordinary specimen of urine at a later date, and in pure culture from the material evacuated from the perirenal tissue at operation.

Sugar Reactions, etc.

Repeated subcultures with a view to stabilizing the fermentation reactions, using subcultures from the organism as isolated on three separate occasions, were made with the following results :—

Glucose invariably showed acid and gas within twenty-four hours. Three out of eight strains gave acid and gas in saccharose in forty-eight hours and seven out of eight in four days, the remaining strain showing acid without gas. Four strains showed very faint acid in maltose in twenty-four hours, but the colour rapidly disappeared; all strains showed small bubbles of gas in the fermentation tubes containing maltose medium in four days.

Sterile acid urine inoculated with the organism and incubated at 37° C. turned alkaline in from three to six hours, depending upon the original acidity of the urine and the number of the organism inoculated.

Serological Reactions, etc.

A high titre serum was prepared which agglutinated six strains to 1/10000, two strains did not agglutinate at the lowest dilution put up (1/500). These results were obtained using emulsions from agar slopes; broth cultures were not agglutinated to so high a titre, the results ranging from 1/250 to 1/2500; this was also the case with the patient's own serum. A serum of still higher titre (1/50000 when fresh) was prepared and carbolized, the titre subsequently falling in about a month to a standard agglutination of 1/5000, or a trace in 1/10000. This serum was used for any further investigations, though it was really of rather too high a titre for convenient use. Using this serum the two non-agglutinating strains agglutinated to 1/50 and 1/100.

On March 26, 1931, I received subcultures of *B. proteus* X 19, serum prepared against this organism, and standard agglutinable emulsions of two strains of the same organism. These were very kindly sent by the officer in charge of the Enteric Laboratory, Kasauli, to whom I had appealed for any proteus cultures or sera he might be able to let me have for purposes of comparison.

Four strains of the organism isolated from this case, and two strains of a proteus-like organism isolated from the fæces of a living rabbit and from the internal organs of the same animal after death were put up with the Kasauli serum (titre 1/1000), with negative results.

These two rabbit strains were agglutinated by the serum prepared in this laboratory at a titre of 1/125 (trace).

Both strains of *B. proteus* X 19 (standard emulsions) were agglutinated by our serum to 1/2500 (in one case to trace in 1/5000).

The following absorption tests were carried out:—

(1) Our serum was absorbed with the homologous organism:—

Titres after absorption for homologous organism	1/125
Rabbit's organism	0
X 19	1/250

repeated with smaller absorbing dose:—

Homologous organism	1/1000
X 19	1/1000

(2) Our serum absorbed with X 19.

Homologous organism	1/5000
Rabbit..	0
X 19	1/500

(3) Our serum absorbed with *B. proteus* from rabbit.

Homologous organism	1/5000
Rabbit..	0
X 19	1/5000

(4) Our serum absorbed with non-agglutinating strain from patient.

Homologous organism	1/5000
X 19	1/2500

From these results one may deduce that (*a*) the organism with which we are concerned is a member of the group of organisms known as *B. proteus*, but is not identical with *B. proteus* X 19 of Weil and Felix, though closely related to it, more closely than it is to the common putrefactive or intestinal strain isolated from the rabbit ; and (*b*) more than one strain of *B. proteus* actually participated in this infection, since one organism was isolated which not only failed to agglutinate in any but a very low titre of the serum prepared, also failed to absorb the agglutinins from that serum.

Cultural Characteristics.

The appearance of the growth on agar was not always characteristic. On several plates the colonies were discrete and showed no tendency to spread, while in others the growth was of the spreading character described as typical. The former variety of growth became more common on repeated subculture at 37° C. These two forms of colonies correspond with the H and O forms of Weil and Felix, described in connection with their *B. proteus* X 19.

The earlier agar slopes made usually showed growth of a spreading nature, and agglutination in such cases was a heavy flocculation, a type similar to that usually seen with motile organisms of the coli-typhoid group (H type agglutination). The agglutination with broth cultures usually tended to be fine and granular (O type agglutination). Those strains giving only a low titre in the first series of agglutinations carried out also showed agglutination of an O type, as did the organism isolated from a rabbit. This would be explicable on the assumption that these strains had a common O factor, but divergent H factor.

On further subculturing it was noted that some agar slopes showed spreading H growth and others discrete O growth.

Agglutinations carried out with such slopes gave the following results :—

Four spreading growth slopes showed H agglutination to 1/5000 (1/10000 in one case).

Two discrete growth slopes showed in one case O type agglutination to 1/10000, and in another a mixed type, but mainly O (i.e., a few heavy flocculi but mainly granular agglutination) to 1/5000.

Broth cultures were tested again, using very dilute broth suspensions, and in one case, though subcultured from a spreading plate, O agglutination to 1/500 was noted. In another, isolated from a discrete slope, mixed agglutination to 1/5000 was noted.

COMPARISON OF THE BIOLOGICAL CHARACTERISTICS OF THE ORGANISMS UNDER DISCUSSION WITH THOSE DESCRIBED FOR *B. proteus* BY VARIOUS AUTHORITIES.

Organism under discussion.

Motility	Gram.	Lactose	Glucose	Saccharose	Maltose	Mannite	Indol	Milk	Acid urine
+	–	–	A.G.	A.G. (late)	A.G. (± ?)	–	–	Acid, later alk., no clot, no peptonizing	Alk. in 6 hours
Four Forms described by Park and Williams.									
(1) *Proteus vulgaris.*									
±	–	–	A.G.	A.G.	A.G.	–	±	[1]No clot, no peptonizing	
(2) *Proteus mirabilis.*									
+	–	–	A.G.	A.G.	—	–	–	,,	
(3) *Proteus valerici.*									
+	–	–	A.G.	A.G.	A.G.	A.G.	–	,,	
Proteus hydrophilus.									
+	–	A	A.G.	A.G.		A.G.		Coagulated	
Hiss and Zinsser [1] speaking generally of the *Proteus* group give :—									
+	–	±	A.G.	A.G.				Acid coagulated. Peptonized	

[1] Thus in the table. In the text they say "milk is coagulated with the production of acid and later digestion of the casein—it produces indol."

B. cloacæ is described as similar to the above, but less motile and causing slight fermentation of lactose after a few days; even sugar-broths become alkaline owing to protein decomposition. Park and Williams also mention a "*urobacillus liquefaciens septicus* described by Krogius" as a member of the group.

The Medical Research Council Special Report Series, No. 51, states that the use of fermentation tests for *B. proteus* is unsatisfactory, "partly owing to the property it often possesses of bleaching most of the indicators employed" (e.g. litmus), "and partly owing to its powers of breaking down nitrogenous materials into alkaline substances which tend to neutralize any acid produced by the fermentation of the sugar."

The report further states that under ordinary conditions lactose and mannite are not fermented; that milk is clotted and peptonized and urine is rendered highly alkaline in four to six hours at 37° C. by production of ammonia from urea, and that there are several serological races.

Castellani describes *B. proteus* as being Gram-positive, and he has given entirely different names to various organisms which would appear to fall within the group as described by other authors.

It would appear from the conflicting views quoted above that further investigation of this group of organisms is very desirable.

Conclusions from the Above.

(1) Sugar reactions, and even such points as milk coagulation and indol formation, as a means of differentiating separate races within this group are quite unreliable, and race distinctions based on such variations in behaviour as tabulated by Park and Williams are probably artificial and should be abandoned.

(2) Too much stress should not be laid on the characteristic growth, because on litmus lactose bile-salt agar at 37° C., the O type of colonies is very common. Felix produced this type of colony at will by maintaining the growth at an elevated temperature, and Braun and Schæffer by using agar medium, poor in nutritive substance, or containing 0·17 per cent phenol. The frequency of O colonies in the plates made in this laboratory may also be accounted for by the fact that 37° C. is above the optimum (25° C.) for *B. proteus*, and some of the constituents of the litmus lactose bile-salt agar may have had a slight inhibiting effect.

(3) The possibility of this organism being present and exercising a pathogenic rôle should always be borne in mind when, after plating urine or fæces on litmus lactose bile-salt agar, *large*, *well-grown*, blue colonies are observed on the plate in twenty-four hours. The organisms should be put up against the patient's serum, especially if glucose only (as this appears to be the most definite of the sugar reactions) is fermented with formation of gas, whether or no indol is present. This is of particular importance in India, where in the large majority of stations the use of gelatine (the liquefaction of which is the most definite characteristic of the proteus group) is impossible owing to the normal high temperature.

One would also suggest that a polyvalent serum should be issued by those laboratories which send out supplies of high titre diagnostic sera.

My thanks are due to Major J. S. K. Boyd, R.A.M.C., Assistant Director of Pathology, Southern Command, for his help and advice with regard to the investigation of this organism, to Major C. D. M. Buckley, M.C., R.A.M.C., Officer in Charge, Enteric Laboratory, Kasauli, for sending me subcultures, emulsions, and sera of *B. proteus*, X 19, and to Lieutenant-Colonel C. R. Millar, D.S.O., R.A.M.C., Commanding British Military Hospital, Wellington, for his permission to publish these notes.

REFERENCE.

[1] Zinsser, H. A Textbook of Bacteriology, 1927, p. 543. New York and London: D. Appleton and Co.

THE DIPHTHERIA CARRIER.

By Lieutenant-Colonel A. C. AMY, D.S.O.,

Royal Army Medical Corps.

It is with diffidence that I tackle this subject, because I feel I am about to offend the majority. There are so many people who, if they possess any clinical sense, shamefully abandon their heavenly gift on the steps of the laboratory; and who, if they are endowed with any common sense, strangle their priceless portion with red tape and bury it beneath a mass of regulations.

I own 'twas rash, an' rather hardy,
That I, a simple country bardie,
Shou'd meddle wi' a pack so sturdy,
Wha, if they ken me,
Can easy, wi' a single wordie,
Lowse hell upon me.

Nevertheless, and like Robert Burns, I propose to carry on.

In the Journal of the Royal Army Medical Corps, November, 1930, there is an excellent article entitled "Diphtheria and its Sequelæ in the North-West of India," by Major S. Smith, R.A.M.C.

The minority will read, mark, learn and inwardly digest.

The majority—those who mistrust their clinical powers and have forsaken common sense—will shiver in their shoes.

"Imagination is the mightiest despot," and Major Smith has conjured up the tyrant in a number of pronouncements of which the following is as typical as it is striking.

> "If every case of sore throat, however mild, be regarded as potential diphtheria, at least in districts and during the seasons in which this disease is prevalent, we shall see fewer cases of post-diphtheritic paralysis than is now, unfortunately, the case."

There are other statements of the same kind, backed up by a number of dramatic illustrations, and the net result is that the reader (i.e, nearly everybody, except you and me) forms a picture something like that on the opposite page.

What is the genesis of this picture?

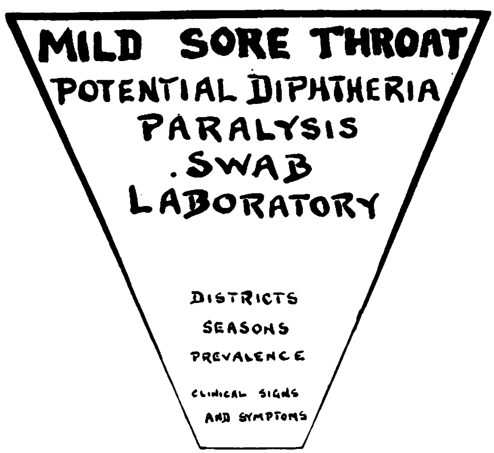
Here one is tempted to revert to a well-worn theme; and the temptation is so strong that it cannot be resisted.

The Great War was brutalized by science and so deprived of practically all military glamour. The Great Peace is dominated by mechanics and clinical romance languishes unto death.

This is the age of countless "specimens," of rationalized methods, of standardized results and of mass-production diagnoses which are turned out by a medical factory : the laboratory. That is the amusing part of it all, because the rôle which is now being played by the laboratory in this huge business concern is a visitation for past misdeeds : a Nemesis—and an American one at that.

One is old enough to remember the rise of "laboratory methods" : with what scepticism they were received by the old-fashioned clinician : with what ardour they were pushed by the enthusiastic scientist : how the clinician fought against depreciation of the power of his five senses, and how the scientist urged the unquestioned recognition of his demonstrable facts.

The mysterious finesse of the human was pitted against the measurable accuracy of the machine.



Then followed a period of balance, when the clinician discovered that the scientist could render valuable help, and the scientist realized that his machines were neither infallible nor omnipotent in the war against disease. This period was marked by such watchwords as "co-operation" and "co-ordination."

It did not last long.

Soon the medical schools poured out an unending stream of individuals who found the rôle of *rapporteur* much to their liking ; and these individuals are still with us.

The clinician of the pre-War type is dead, buried, and almost forgotten. He is lucky, for had he survived a little longer, he (or many portions of him) would have gone to swell the ever-increasing mass of specimens which are being dumped in that capacious repository, the laboratory.

In face of this, what attitude is being adopted by the laboratory workers?

These gentlemen are now in the front rank of those who declare that

an ounce of informed, intuitive clinical observation is worth a ton of negative swabs, of guinea-pigs, of colonies like unto the breasts of a virgin. However, the scientists, having started the snowball rolling, now find that the thing has developed into an avalanche in which they themselves are engulfed and swept along.

That is the general aspect of the trouble. The narrower view may be obtained by looking once again at our picture. Note its big, heavy superstructure: very imposing. See the small, delicate base: very safe. Very safe, that is to say, for the doctor; but terribly unsafe for the patient. A light touch and the whole thing goes over, crashes on the unfortunate patient and pins him to the isolation ward for weeks and even for months.

If the picture is so finely balanced and so easily thrown over, why does it never fall in the opposite direction and knock the specimen-producing doctor on the head?

For this there are several reasons.

(1) Observe that, in the picture, there is a gap between the words "Laboratory" and "Districts."

This represents the period during which the medical attendant is pondering over—

MILD SORE THROAT.
POTENTIAL DIPHTHERIA.
PARALYSIS.

and is collecting serum and testing his syringe, pending the arrival of a report from the laboratory.

Soon the report comes in, and this is how it runs :—

"K.L.B., or organisms morphologically identical with K.L.B."

When you or I receive this report we administer serum, do some clear, hard thinking, communicate with the bacteriologist—verbally, if possible—and perhaps consult our colleagues.

Not so the majority of folk : they inject the serum, enter "Diphtheria" in the A. and D. Book, and broadcast infectious disease reports all in one breath. The patient is docketed and damned, and his services are lost to His Majesty for an indefinite, and often lengthy, spell.

A false step has been taken, and it cannot be retraced.

(2) MILD SORE THROAT.
AN EQUIVOCAL REPORT FROM THE LABORATORY.
DIPHTHERIA DIAGNOSED.
THE BOGEY OF PARALYSIS.

The M.O. has now lost the initiative, and the patient has now lost his liberty, because the subsequent proceedings are governed by certain regulations.

The Home regulations are not too rigid: they permit of a certain amount of personal interpretation.

"Convalescents from this disease should not be discharged from hospital until they have clinically recovered, are free from nasal discharge, have normal throats, and are no longer carriers of virulent bacilli."

(Note: *virulent* bacilli.)

But the Indian regulations are different, and leave no loophole of escape for the timid or the obstinate. They start off with a paragraph similar to the one quoted above, and then continue thus:—

"3 negative swabs, taken at least 12 hours after any medication to the throat, at 3-day intervals are required before a case or a carrier can be considered 'free'."

(Note: presumably the regulation means "3 *virulent*-negative swabs.")

A trap has been entered and there is no escape.

(3) MILD SORE THROAT.
POTENTIAL DIPHTHERIA.
PARALYSIS.

Major Smith's lurid triumvirate hypnotizes the reader who, though bereft of sight to read, still retains sufficient strength to overcome his victim, the inoffensive patient.

Were the reader able to continue with eyes open and judgment unimpaired, he would find that Major Smith's next paragraph is worded as follows:—

"The presence or absence of K.L.B. in a throat swab is only one of the factors that should sway our judgment for or against diphtheria; other signs of almost equal importance being membrane on the tonsils, especially if involving the uvula, enlarged and painful tonsillar or cervical glands with sore throat, continued sore throat that persists in spite of treatment, a low continued pyrexia (although diphtheria with high temperature is common in this country [India]), a white face and small rapid pulse, albumin in the urine, etc."

Now, what is the significance of "K.L.B., or organisms morphologically identical with K.L.B."? What is the value of such a report?

Just this: Beware! *ATTENTION!*

You and I know this. We take the information for what it is worth, and weigh it in the scales with "other signs of almost equal importance." Not so the other fellow: by his actions one can almost hear him repeating—"Virulent? Yes—no—*yes*—*No*—YES!" and the mischief is done.

He is blind and has put himself—and his patient—beyond the reach of succour.

(4) It behoves a blind man to be cautious: it is up to him to play for safety; and it is this fact (coupled, sometimes, with an erroneous appreciation of the factor of risk) which prevents the mischief from being undone.

You follow the sequence? A false step was taken. This step led to a trap which blurred vision failed to detect and moral weakness was powerless to avoid.

This brings us to grips with what is, to most people, a knotty problem : one which they find difficult, and regarding which they are not always as well informed as they might be.

The margin of safety or, if you like, the factor of risk: that is the problem, the bugbear, the fog which defies penetration.

As a rule it is avoided : in ignorance the margin of safety is reduced, the element of danger is exaggerated, the M.O. is covered and the patient continues to be an unproductive charge on the State.

Obviously, this is a problem worthy of discussion; but before saying something about it I would remind the reader that, of the total number of cases diagnosed diphtheria, very many are condemned by "K.L.B., or organisms morphologically similar to K.L.B." A few are labelled "Diphtheria—clinical," and still fewer bear the hall-mark "K.L.B. proved virulent by animal inoculation."

Why is this last class such a small one?

Firstly because, for a number of technical reasons, it is not always easy to carry out the virulence test to a successful conclusion.

Secondly—and of more importance—because it is comparatively rare to find a patient of the MILD SORE THROAT—POTENTIAL DIPHTHERIA—PARALYSIS type who is actually harbouring virulent K.L.B. In other words, and unless due attention be paid to those "other signs of almost equal importance," M.O.'s will continue to throw patients into durance vile, and pile up the bill for carriers, when the majority of these patients and carriers are not, and never have been, sufferers from diphtheria. Any unprejudiced observer who cares to make a careful clinical study of such patients and carriers (*sic*) will soon convince himself of the truth of this assertion.

Although we cannot feel enthusiastic over trans-Atlantic, standardized, mass-production clinical methods in the laboratory, still we must be grateful for many careful and conscientious American investigations on the grand scale, and particularly in the field of vital statistics.

Several investigations of this kind have been carried out on the problem of diphtheria and the diphtheria carrier, and the results of one of the best of them were published in Circular No. 60, Chief Surgeon's Office, American Expeditionary Forces.

The facts and figures which follow are taken from this circular. They may differ a little from those reported by other investigators, but it is not thought that the divergencies are such as to vitiate the present argument.

I am aware of the danger of making quotations divorced from the context; but I have tried to make a fair paraphrase of the relevant parts of the circular; and if I succeed in inducing some to study this valuable document from beginning to end I shall be well content.

"Practically speaking, an avirulent strain of diphtheria bacilli never acquires virulence, and a virulent strain retains its virulence with great tenacity.

Clinical diphtheria is produced only by virulent diphtheria bacilli.

Single throat cultures from healthy individuals of various ages reveal *B. diphtheriæ* in one per cent to thirty per cent. The average incidence appears to be three to four per cent.

Among the bacillus carriers the per cent of carriers of virulent bacilli varies greatly, but is commonly found to be ten to fifteen per cent of carriers.

Therefore, only 0·45 to 0·6 per cent of healthy individuals carry virulent *B. diphtheriæ*.

If daily cultures are taken from the throats of chronic carriers, very interesting and instructive results may be obtained:—

(i) Positive cultures may be obtained for a number of consecutive days, extending perhaps over weeks.

(ii) A majority of the cultures may be positive, with occasional negatives interspersed among the positives.

(iii) A majority of the cultures may be negative, with occasional positives interspersed.

(iv) Regularly positive cultures may be obtained for a number of days, followed by a period in which the results may be irregular. After this, regularly negative cultures may be obtained—and then the whole sequence of events may be repeated as above, and repeated many times over.

This is probably to be explained by the successive coming to the surface of depth colonies of bacilli, when the superficial layers of the tonsils exfoliate.

Carriers who have not been in close contact with an active clinical case of diphtheria are of little importance in the spread of the disease, since more than eighty-five to ninety per cent harbour only non-virulent bacilli.

Infection does not readily occur from the remaining ten to fifteen per cent who constitute a possible source of infection for susceptible persons.

Isolation of healthy carriers is impracticable because:—

(1) Of the labour involved in detection of all carriers.

(2) If all carriers in a large group were detected, their number would be too great.

(3) Many carriers remain carriers indefinitely. Wholesale radical sterilization (tonsillectomy) is impossible.

(4) They do not constitute a menace serious enough to justify any of the above procedures.

(5) If, for any reason, an attempt is made to detect and isolate carriers, virulence tests should be performed, and the carriers of avirulent bacilli should be disregarded; while the healthy carrier of even virulent bacilli does not constitute a serious danger to persons in contact with him.

Experience has shown that approximately fifty per cent of mankind are naturally immune against diphtheria. This immunity is due to the presence, naturally, of a small amount of diphtheria antitoxin circulating in the blood.

To prevent the spread of diphtheria the most important measures are: (*a*) the prompt recognition and effective isolation of cases; and (*b*) when diphtheria is prevalent, frequent throat inspections of all likely contacts, with isolation of all suspicious cases until negative cultures prove that suspicion is unfounded.

There are certain measures that have become so well established in dealing with epidemics of diphtheria, that to question them is sure to arouse the antagonism of those whose ideas have become fixed by tradition: for instance,the wholesale taking of throat cultures. A knowledge of the practical limitations of the practical application of wholesale culturing to organizations or groups among which diphtheria has appeared, and the poverty of actual results in detecting the insignificant incidence of carriers of virulent *B. diphtheriæ* should suffice to forbid the practice.

During an outbreak of diphtheria :—

(1) Among adults there is a seventy-five per cent factor of safety to start with, represented by natural immunity. This is further increased by the chance that, of the twenty-five per cent of susceptible adults, not all of them will have diphtheria bacilli implanted in their throats.

(2) There is no danger from the carrier of non-virulent bacilli; and the danger from the ordinary healthy carriers of virulent bacilli is so slight that it does not seem practical to take any measures against it.

(3) It is probable that unrecognized cases of diphtheria are the most potent agents in giving rise to the spread of the disease."

Reference has been made above to the rigidity of the Indian regulations which deal with this matter. The disabilities attendant on this rigidity must have been realized at Army Headquarters, Simla, because Circular Letter No. Z 6671/1 (D.M.S. India, 5) dated August 6, 1928, after referring to Regs. M.S.A. (*T*), goes on to say that :—

"Difficulty in some cases is experienced in dealing with contacts from whom *B. diphtheriæ* (K.L.B.) is reported from the laboratory as having been isolated, without information as to the virulence of the isolated organism. I am to say that laboratory reports should invariably state whether or not the organism has been proved virulent by means of animal inoculation, although a *preliminary* report should be sent immediately the organism has been found."

But that is not all: there is a concluding sentence; and it is this

sentence which, in my opinion, should render Circular No. Z 6671/1 (D.M.S. India, 5) of August 6, 1928, one of the most popular and most famous circulars ever issued by D.M.S. India.

Ours is a progressive Corps, willing to learn, eager to advance. I suggest that we incorporate the sentence referred to, in our next Christmas card : something like this :—

"A HAPPY CHRISTMAS! AND IF YOU REMEMBER THAT, *in all cases, laboratory reports should be taken as a guide only, the ultimate responsibility resting with the officer in medical charge,* YOU WILL ENSURE TO YOURSELF A BRIGHT AND PROSPEROUS NEW YEAR."

SIMPLE EYE WORK FROM THE POINT OF VIEW OF THE NON-SPECIALIST.

By Major J. BIGGAM, M.C.,
Royal Army Medical Corps.

These notes have been written entirely from the point of view of assisting the medical officer who in the absence of any one with special training in the subject on whom he might call for advice, has to deal with eye cases in a medical inspection room or the ordinary wards of a hospital.

Only the common diseases, which are likely to be met with under these conditions, have been considered, and the general line of treatment applicable to the average case indicated.

The notes are consequently rather elementary in parts and more of the nature of helpful, if scrappy, "tips" than otherwise.

Instruments.

Almost all the work discussed here can be carried out without any special instruments, or with the help of those available in the ordinary hospital.

A few special instruments and appliances which are a comfort in the routine examination and treatment of simple eye conditions will be mentioned.

Electric Ophthalmoscope.

For the kind of work we are discussing, the most useful type is probably the May's electric ophthalmoscope. It is cheap, strong and easy to manipulate. When buying this instrument it is most important to see that the handle is sufficiently large to take the large-size unit cell used in the ordinary cylindrical electric torch. This will save infinite trouble in battery replacements, especially abroad.

It is possible to get an electric auriscope to fit the handle of the May's ophthalmoscope and the two together form a very valuable combination. The cost is about £5.

A set, of excellent London make, is available, containing in a case an electric ophthalmoscope, an auriscope and three specula, a nasal speculum, a tongue depressor, a laryngoscope, retinoscope and condensing lens. The price is £7 15s.

Spare bulbs for electric instruments should not be forgotten when going abroad.

When new batteries are used a resistance should be employed to cut down the current, otherwise the bulbs are apt to burn out rapidly. Bulbs cost about 5s. each. If not overrun they last a long time.

The May's ophthalmoscope, although by no means the best for fine work, has the advantage; that by merely removing the head containing the lenses it can be used to illuminate the eye. If the condensing lens on the stem is then pulled forward until it almost drops off, a simple and wonderfully efficient "hand slit lamp" is obtained. One of the earliest signs of appearance of an iridocyclitis and one of the latest signs to disappear when the inflammation subsides, is the "flare" in the aqueous when illuminated by this simple "slit lamp." The normal aqueous is almost optically inactive, but the highly albuminous aqueous of an iridocyclitis shows up the passing beam of light, just as the beam of a torch, invisible on a clear starry night, becomes very obvious when the air is laden with mist.

The slit should be first adjusted by focusing on the finger nail and the light then thrown obliquely through the cornea and lens. The beam passing through the aqueous is observed from in front between these two fixed points of illumination. This examination is easier against the large black background of a dilated pupil and is also easier when magnified, but the effect can be seen with the naked eye and undilated pupil. By the same means the depth of the anterior chamber and opacities in the cornea and lens may be examined. The ophthalmoscope, when used in this way, should be held like a pen, being gripped close to the lamp bulb, thus ensuring good control over the light.

Magnifying Apparatus.

A single loupe, magnifying 10 diameters, is useful for eye work (as well as for entomology), but should be of good quality. Such a magnifying loupe costs 25s.

A Zeiss binocular prismatic loupe magnifying three diameters gives an excellent stereoscopic view of the eye, but costs about £4.

Neither of these, although very useful, is essential for the work we are discussing.

Focusing Electric Torch.

An ordinary cylindrical focusing electric torch is invaluable for illumination of the eye in detecting disease, testing pupil reflexes inside a dark ward, in the removal of foreign bodies, etc. I have found the Winchester two-cell torch the most suitable. It can be focused to any distance or intensity of illumination required. The same unit cell batteries used for the torch should fit the ophthalmoscope handle.

In using such a torch for eye illumination a short focus should be employed and the light thrown on the eye obliquely from the side. Incidentally a similar light of less intensity gives quite a good illumination for operative work.

Eyelid Retractors.

In dealing with cases, especially babies, suffering from an acute conjunctivitis or corneal ulcer, when it is essential to inspect the condition of

the cornea, pain, photophobia and blepharospasm may make the use of eyelid retractors necessary, even after the instillation of a drop of cocaine.

The simplest retractor is that made of bent silver wire. These can be bought for a few shillings in England and copied for a few annas in India.

When using such a retractor avoid injury to the corneal surface or pressure on the eyeball (which might rupture a deep corneal ulcer) by lifting the lids forwards away from the cornea at the same time that traction is exerted, so as to expose the corneal surface.

In babies the employment of a retractor is also often necessary to admit of efficient irrigation of the conjunctival sac.

Irrigating Bottles.

Undines are sometimes difficult to obtain in a hospital and are easily broken. A small enamelled iron tea-pot makes a fairly effective irrigator. Quite a good irrigator can be made from an eight-ounce bottle, preferably with a rubber cork, fitted with glass tubing of three millimetres (or more) internal diameter, arranged as in the distilled water bottle used for flushing microscopic slides.

The fluid used for irrigation should be at blood temperature. Normally if both lids are strongly pressed back over the orbital margins, while the patient looks alternately up and down, the lids will lift sufficiently away from the eyeball for effective flushing of the whole conjunctival sac. The upper lid can be everted if required.

Examination of the Eye.

External Examination.

If ordinary daylight illumination is insufficient a more concentrated light can be obtained by focusing on the eye with a condensing lens the light from a window or from an electric bulb held about three feet away. The ordinary Morton's ophthalmoscope case contains a suitable condensing lens.

The patient should be so placed that the light comes from above the level of his head and from the opposite side to the eye which is being examined. This obliquely incident light allows of a clear view of the eye being obtained from the front, and of unobstructed magnification if required. A focusing electric torch as already suggested gives a very satisfactory illumination.

For those of us who are approaching the presbyopic age and who do not possess such an instrument as the prismatic binocular loupe, a Bishop Harman spectacle loupe (price about 18s.) or one of its modifications will be found a great convenience. It consists of a pair of spectacles fitted with plus 5·00 dioptre lenses combined with prisms, base in, to relieve the convergence effort, and allows of clear vision up to about four inches from the object looked at.

Eversion of the Upper Lid.

To make this manœuvre easy and painless the patient must keep looking downwards, and the lid, firmly grasped by the central lashes, must be pulled well down and away from the cornea before it is hinged up rotating on the upper border of the tarsal cartilage. A touch with a finger or a match at the upper border of the tarsal cartilage provides a fulcrum for this rotation. So long as the patient continues to look down the faintest pressure on the free margin of the lid will maintain eversion. The lid will automatically return to its normal position when he looks up.

Examination of the Cornea.

Local ciliary injection will often point to the situation of a minor corneal lesion or foreign body. A minute corneal lesion not otherwise obvious may be discovered by directing the patient to follow one's moving finger, until the injured area shows against the corneal light reflex. Small ulcers, abrasions and foreign bodies, invisible against the coloured iris background, may often be seen when by a similar manœuvre they are brought opposite the background of the "black" of the pupil. In difficult cases, dilatation of the iris with homatropin will render this much easier.

Any condition, abrasion or ulcer, resulting in an injury to the corneal epithelium, may be readily demonstrated by staining with fluorescein. A quarter of a drop of this solution is placed in the lower conjunctival sac by means of a match, glass rod or pipette, and the patient instructed to blink a few times, or the solution is placed on the upper margin of the cornea and allowed to flow down over it. After a few seconds it is washed out with a few drops of any innocuous solution and the cornea is examined. Any area, denuded of epithelium, from whatever cause, will be found stained a brilliant green.

Fluorescein solution is difficult to make up satisfactorily. It is exceedingly cheap and is best bought ready made. A few pennies-worth will last for a year.

The staining is more easily seen with daylight illumination or with the use of a "daylight" electric bulb.

Hypopyon and Hyphæma and K.P.

The crescent of sterile pus lying in the bottom of the anterior chamber (as the result of a severe corneal ulcer or severe iridocyclitis) and that of blood (from an injury) in the same situation are usually easily seen unless very small in amount, but the aggregation of cells plastered on the lower half of the posterior surface of the cornea (keratitis punctata or keratic precipitates, one of the most important signs of an iridocyclitis) may require magnification unless gross, before they can be seen. They are much more easily seen against the black background of the dilated pupil.

The brightness, colour and mobility of the iris to light, irregularity of its pupillary border or adhesion to the lens capsule (posterior synechia) are important points to look for when examining a questionable iritis.

Cataract.

Cataract in an elderly person should not be diagnosed by direct inspection. An old lens may be so dense as to reflect much of the light falling on it, and this white appearance gives the impression of its being opaque, when in reality it may be perfectly transparent, e.g., when examined by the transmitted light of a mirror (retinoscope) or the ophthalmoscope in the dark room.

External Examination of the Eye in Infants.

The following applies also to the treatment of infants and young children.

The best method of immobilizing infants and young children for. examination and treatment is as follows:—

For Treatment.—The nurse and doctor sit facing each other. The child is placed on the nurse's lap so that she can control its arms and legs. The child's head is held between the doctor's knees, leaving both his hands free to open the lids or to put in retractors.

For examination of the eye this position will be found to be too low, and the doctor's feet should rest on a box about twelve inches high. This will raise the child's head to the correct level for examination.

In all cases of acute conjunctivitis in infants it is essential to inspect the cornea and note whether ulceration has or has not occurred. It is quite easy to do this if the child is immobilized as described above and a retractor or retractors and an electric torch are used.

Use of the Ophthalmoscope.

With practice much can be done with a pearl electric bulb held in the hand and an ordinary Morton's ophthalmoscope, used in a partially darkened room. For the type of work we are considering, however, an electric ophthalmoscope is simpler to use.

First dilate the iris with homatropin (formula given under "Prescriptions"). One drop of this solution in each eye, repeated every ten minutes, should produce sufficient dilatation for examination in thirty to forty minutes. The eyes must be kept gently closed while dilatation is proceeding. In persons over thirty-five years old a drop of half per cent oily eserine should be instilled afterwards to avoid any possibility of precipitating a glaucoma. Watery eserine may be used if the oily solution is not available. Atropin should never be used for diagnostic purposes, as its effect, once established, is uncontrolled by any drug, whereas the dilatation of homatropin can be neutralized in an hour by repeated instillations of eserine.

The patient should be seated in a chair, the observer carrying out the examination standing. The room should be darkened as much as possible, but the fundus can be seen fairly well in a brightly lit room.

After the cornea had been examined by the illumination of an electric

torch or by the ophthalmoscope with the lens head removed and used as a torch as already described, the condensing lens should be adjusted and the cornea, aqueous, iris and lens swept with the "slit lamp" so obtained. Corneal damage, aqueous abnormalities, synechiæ, lens opacities, etc., will be seen in this way. A good view is obtained of anything in front of the posterior capsule of the lens.

The condensing lens of the ophthalmoscope having been pushed home and the lens head replaced, ophthalmoscopic examination proper is begun. The observer uses his left eye to examine the patient's left eye. The highest plus lens available is turned into the sight hole (plus twenty in the May) and the head of the ophthalmoscope firmly fitted into the observer's eye socket like a monocle. Any further movements will then be carried out by moving the head and the ophthalmoscope in one piece. The ophthalmoscope is then brought up to the eye under examination until the cornea appears clearly in focus. If the observer is unaccustomed to use the instrument in this way, it should be tried on a wrist watch or thumb nail. Corneal opacities, corneal vascularity, etc., show up well by this method.

By maintaining the same distance from the eye and putting up plus lenses of decreasing strength the whole eye mediæ from cornea to retina can be successively brought under observation. The state of the patient's refraction and the accommodation exercised by the observer will determine with which lens the retina will be brought most clearly into view.

To focus a blurry retina the habit should be acquired of whirling the lens wheel rapidly to and fro just as in focusing a microscope slide, until the required focus is obtained. When the end point of focus is nearly reached individual lenses may be brought one by one in front of the sight hole till the best definition is obtained.

The fundus should be examined systematically, starting from the optic disc. The periphery of the visible portion of the retina can be reached by asking the patient to look in various directions while the observer inclines his head and ophthalmoscope in the diametrically opposite direction.

If at any time the observer "loses his way" in the fundus he should trace a vessel back to the disc and start again. The macula lies two and a half disc diameters to the temporal side of the disc and a little below it. If the actual little pin-point macular reflex cannot be seen, the macular area can always be recognized by the absence of blood-vessels.

Such fundus conditions as disseminated choroiditis, gross papillœdema, retinal hæmorrhages, albuminuric and diabetic retinitis, the retinitis of pregnancy, signs of injury, such as choroidal tears and subretinal hæmorrhages, are all easily seen with the ophthalmoscope.

The importance of early recognition of such conditions as papillœdema, albuminuric retinitis or the retinitis of pregnancy need not be stressed.

It is comparatively easy at any rate to determine whether a fundus abnormality is present and requires investigation or not, and in the course

of the routine use of the instrument one learns to recognize such "normal" and unimportant abnormalities as the "angry" looking hypermetropic fundus, the "stretched" looking fundus of the low degree myope or the "grenade" of white medullated nerve-fibres which are so disconcerting when seen for the first time.

Squint.

We need not here concern ourselves with such conditions as paralytic squint, adult concomitant squint, or the relation of muscle balance errors (heterophorias) to squints. Concomitant squint in children only will be considered.

Spurious Squint of Infants.

During the first few months of life, before the fusion faculty has made much progress in development, an infant's eyes may converge for a few seconds at a time in response to some gastric or other disturbance. This is of no importance. If, however, one eye converges while the other steadily fixes an object after the child is six months old the case is probably a true squint and requires investigation. The child should have developed binocular fixation and should not squint by the time it is from six to twelve months old.

Apparent Squint of Children.

It is common to have a young child with no apparent deviation of the eyes brought by its mother with the story that "the child sometimes squints" or "the neighbours say I should have the child seen to as it squints." It is well to remember in these cases that a young child with undeveloped nasal bones, and consequently a broad, flat nasal bridge, may have a fold of skin (almost an epicanthus) covering the internal canthus to such an extent that when the child looks sideways one cornea partly disappears from view, thus producing the appearance of an internal squint.

In these cases, if the corneal reflex of a door or window is observed to occupy the same relative position in each eye of the patient, the eyes are not squinting. A more accurate rough test in such cases is to shine the light from a focused electric torch into the child's eye from several yards distance. If, when the child looks at the light from various angles, the corneal reflex of the light is seen to be central in each pupil the child's eyes are straight at the time of examination.

The best method of doing this test is to place the child (in the mother's lap if necessary) in the dark room with the light behind its head, and reflect the light from the mirror of an ophthalmoscope or retinoscope into its eye. Even an infant will at once look at the light, and the bright spot of light—the image of the mirror—is seen on the patient's cornea. This reflection should be almost in the centre of each pupil; actually it is slightly to the nasal side of the centre of the pupil. If a squint is present the deviating eye can be noted and a rough guess at the angle of deviation made.

Concomitant Squint of Children.

Seventy-five per cent of squints occur between the first and fourth year, the commonest age being between two and three years.

A premonitary occasional squint in a child over one year old is probably the precursor of a constant squint, and will usually become constant in two or three months if neglected.

A child which has a definite squint should be brought under treatment without delay at whatever age it is seen. Glasses, if required, can be worn when the child is about one year old.

The vision of the non-fixing eye in a squinting child is suppressed, leading to an acquired amblyopia, and the younger the child the more rapid is the deterioriation of vision.

If, for any reason, the child cannot be seen by one with special "eye" experience, it is important to try and keep the vision of the squinting eye from deteriorating.

This can be done by bandaging the "good" (or fixing) eye during a third of the patient's waking hours. This is, however, a very troublesome method, and it will be found more convenient to place a drop of one per cent atropin sulphate solution in the "good" eye once a day.

By paralysing the ciliary muscle of the fixing eye in this way the partial use of the squinting eye is ensured, at least for near vision, and thus deterioration of vision from disuse avoided.

There is no danger of causing permanent impairment of accommodative power from the use of atropin, however long continued.

Growing out of a Squint.

With the advent of puberty the angle of a convergent squint often tends to become less—the patient may "grow out of a squint." The squinting eye has, however, unless specially treated, become amblyopic from disuse. The advice to "wait and see if the child will grow out of a squint" should therefore never be given.

Diseases of the Eyelids.

Styes.

These abscesses of the sebaceous glands in the lid margins usually point near the site of an eyelash. Eyelid tissues are very lax and the œdema and pain are out of proportion to the size of the lesion. The treatment is obvious, but it should be remembered that the repeated occurrence of styes indicates the possibility of a chronic blepharitis requiring treatment, or the investigation of the possibility of a refractive error keeping up the condition. In chronic cases the use of stannoxyl, collosal manganese, and autogenous vaccines may be considered in turn.

Blepharitis.

The early form of this is characterized by fine scales round the bases of the eyelashes at their points of emergence. One might describe it is a dandruff of the eyelashes. These scales may require to be stirred up with a match (the tip of which has been tightly wound with a wisp of cotton-wool) to become visible, unless magnification is used, and yet such a mild scaly blepharitis may be the underlying cause of a persistent chronic conjunctivitis, or "tired" or "irritable" eyes.

In the later stages this infection of the follicles (which is by no means confined to children) may result in ulceration, loss of eyelashes and deformity of the lid. If this stage has been reached, treatment, to be of any avail, must be conscientious and persistent.

Treatment.—The scales or crusts must be completely removed by hot bathing, and if necessary by rubbing them out from the roots of the lashes by a cotton-wool-armed match-stick dipped in three per cent sodium bicarbonate. To facilitate access to the lid margin and to avoid the entry of the medicaments used into the conjunctival sac, the lid should be well retracted by hand pressure on the eyebrow.

Slight bleeding, if it occurs in the ulcerative cases, must not be allowed to interfere with the removal of all the crusts. It is useless merely to rub ointment on the surface of the crusts. The lid margin is then thoroughly dried, and a trace of unguentum hydrarg. ammon. dil. on another match-stick is well rubbed into the roots of the eyelashes. Any excess of ointment is afterwards removed.

This treatment, or modifications of it, may, in the ulcerative cases, have to be continued for weeks, months or even years.

If the patient is to carry out the treatment at home, it may be simplified as follows: He should carefully bathe the edges of the lids with a piece of cotton-wool, or clean rag dipped in hot water, until all the scales between the eyelashes have gone. The lids should then be well dried and a little of the ointment taken on the tip of the finger rubbed thoroughly into the roots of the lashes.

Chalazion (Meibomian Cyst).

This, due to an infection of one of the meibomian glands of the upper or lower lid, produces a swelling in the substance of the tarsal cartilage at some distance from the lid margin. On palpation it feels like a small hard pea, the skin of the lid being freely mobile over it. Gradually increasing over a period of weeks or months, it may suddenly become acutely inflamed. A vertical incision through the conjunctival surface of the everted lid and the scraping out of its granulomatous contents is usually required for its removal. The area to be incised may be anæsthetized by a few crystals of solid cocaine, or the lid may be injected from the conjunctival surface with novocain, using a fine needle.

Conjunctivitis.

When a casual examination indicates a comparatively mild conjunctivitis of one eye only, the possibility of a corneal lesion, a foreign body under the upper lid, or an early iritis should be eliminated before the diagnosis of conjunctivitis is made.

Bacteriological investigation of a platinum loop smear, or of a culture from the conjunctival sac is often helpful in determining the type of organism responsible for the inflammation and, consequently, the line of treatment to be adopted.

Gonorrhœal Conjunctivitis.

A simple smear is usually sufficient for immediate diagnosis. The inflammation is a very acute purulent one, accompanied by severe pain, swelling of the lids, and swelling (chemosis) of the conjunctiva. The danger is that of rapid corneal ulceration. The disease may occur at any age.

Treatment.—In the early stages the eye literally drips pus. Irrigation must be almost continuous in this acute stage, say every half hour by day and every hour by night. For this purpose normal saline is probably as good as anything else. Protective goggles must be worn when treating the case. If œdema and chemosis make it necessary, retractors must be used to obtain effective irrigation, but injury to the cornea must be avoided during their use.

The everted lids are thoroughly painted with two per cent silver nitrate solution once a day during the acute stage only. The lid margins are smeared with a bland ointment to facilitate the escape of discharge. The patient should lie on the affected side, and the other eye should be protected with a Buller's shield, which can easily be improvised from a watch glass and sticking plaster. Watch for signs of corneal ulceration.

Muco-purulent Conjunctivitis.

This, although an acute inflammation with a markedly injected conjunctiva and even subconjunctival hæmorrhages, accompanied by a variable amount of discharge, does not usually produce corneal ulceration. It is generally caused by the Koch-Weeks bacillus, but may be caused by the pneumococcus, a streptococcus, or even a staphylococcus. Its treatment will be discussed under that of Acute Conjunctivitis.

Chronic Conjunctivitis.

There is little that can be usefully said here about this trying condition, of which those of us who have spent much time in the tropics, with its glare, wind, dust and flies, have plenty of experience. Treatment is indicated later.

Angular Conjunctivitis.

This slight persistent inflammation, caused by the Morax-Axenfeld bacillus, is characterized by a "plum bloom" colour at the inner and outer

angles of both eyes, the lid margins also being reddened in that situation. It is best seen from a distance of two or three feet. Treatment is indicated below.

Self-inflicted Conjunctivitis.

This is usually produced by everting the lower lids and placing an irritant such as soap, sand or cigarette ash in the exposed conjunctival fornix. It may be caused by simple repeated friction. The results are characteristic. The conjunctiva of the lower lid is red and inflamed, as is also the conjunctiva of the eye covered by the lower lid. On pulling down the lower lid a sharp line of demarcation between this angry infected conjunctiva and the normal pale conjunctiva of the remainder of the eye is noted. The upper lid and the conjunctiva covered by it are normal. There is relatively little discharge from the eye.

Treatment of Conjunctivitis.

That of gonorrhœal conjunctivitis has already been considered.

Acute Conjunctivitis.

As a routine treatment for acute conjunctivitis the following may be adopted :—

(1) Irrigation of the conjunctival sac sufficiently often to keep the eye free of discharge. Traction over the orbital margins will lift the lids away from the eye and enable the whole sac to be washed out. The height of the irrigator should be gradually raised to about four inches so that a forcible stream of fluid directed on the eye and into the fornices may flush away the discharge. The fluid should be at blood-temperature.

A note on the fluids used for irrigation is appended.

(2) Paint the everted lids with two per cent silver nitrate solution once a day only for two or three days in the acute stages. This painting, if done early, may abort an attack of conjunctivitis and should at any rate cut short the disease.

To paint the lids evert the upper and lower lids and press together to shut off the cornea. (No harm is done, however, if the solution does reach the cornea.) Dab the exposed lid surfaces for five seconds with a match stick the end of which has been wrapped in cotton-wool dipped in the silver solution. Mop off the excess with a pledget of dry cotton-wool. Irrigate immediately with normal saline and instil a drop of two per cent cocaine.

The pain is fairly acute for an hour. Painting of the lids can be done with benefit even in small children. (It might be mentioned here that for the application of ointments, the cleansing of the lids of cases of blepharitis, the application of silver nitrate solution to the lids, etc., if neither proper "wood applicators" nor solid glass rods are available, ordinary matches may be used. In India the midribs of the cocoanut palm, used for making

sweepers brooms, are excellent substitutes. They are tough, easily sterilized, and cost practically nothing. A wisp of cotton-wool wrapped round the end adheres well and forms a good swab.)

(3) A little plain vaseline rubbed along the edges of the lids at night will prevent them sticking, and allow of the free escape of the conjunctival secretions.

(4) The eyes should be left unbandaged and freely open in all cases of conjunctivitis with no corneal ulceration. An eye shade or dark glasses may be comforting.

(5) A drop of twenty per cent protargol or argyrol may be used twice a day. It is doubtful if these preparations are of much value. No silver preparation, organic or inorganic, should be used for more than a fortnight or three weeks, because of the risk of producing indelible brown conjunctival staining (argyrosis). Silver preparations should never be prescribed for home use for the same reason.

Note.—A clean fountain-pen filler makes a good eye dropper. In its absence a piece of glass tubing of three millimetres internal bore, fused to smooth the ends and used as a pipette, is satisfactory. In the more chronic types of conjunctivitis, when the patient is given drops for home use he will find the following method of introducing the drops easiest. Standing eight inches from a mirror, pull down both lower lids at the same time, using two fingers of the left hand, suck up a few drops of the solution in a pen filler and looking in the mirror lay one drop in the lower fornix of each eye; allow both eyes to close.

The Use of Fomentations in Acute Conjunctivitis.

Fomentations in simple conjunctivitis probably do more harm than good, producing a sodden effect on the tissues and increasing the risk of corneal ulceration. Hot bathing and hot fomentations are comforting and of therapeutic value in deep inflammations such as iridocyclitis, but not in superficial inflammations.

In cases of acute conjunctivitis, especially in babies and in children, the cornea should be inspected daily for commencing ulceration.

(*To be continued.*)

THE DOCTOR'S WAR.

By D.A.D.M.S.

Much has been written of the Great War from the fighting side. Little has been said of the healing side of it. The British Army was a small one in 1914, but it had a certain system about it, and the immense army to follow was trained and fought on that system. The medical staff of the pre-war army had also a system to prevent disease and keep the army healthy. This system was also applied to the army of 1914-18, and it did much to win the war. The following account of the adventures of a division in France is taken from the rough diary kept by a medical staff officer from August, 1914, to March, 1916.

The Division mobilized for war in Ireland, excepting the Brigade called the "English Brigade," which joined us later. The City of Cork was our headquarters. The minds of most soldiering people in Ireland had been too much taken up with the possibilities of civil war to think over much of European affairs. We had just passed through the excitements of the Curragh incident, and many stories were going about of the resignations of officers who refused to fight against Northern Ireland.

It was obvious that Ireland was very unsettled, as one frequently saw bodies of young men marching about, carrying sticks instead of rifles, and calling themselves the Irish Volunteers, this being a counterblast to the activities of the Ulster Volunteers. Bodies of the Royal Irish Constabulary had been drafted up North, following the long established custom of seeing that Irish policemen were not asked to control their own relations in their own "home towns," but were judiciously sent to other parts of the country.

I heard one of the returned R.I.C. men telling some Cork men his experiences up North. He was asked what these Ulster Volunteers were like, were they well armed, were they in earnest with their threats to fight? His answer was forcible enough.

"Be God," said he. "They have arms, they are serious, and if they come down here they will drive the lot of ye into the say."

On August 4, mobilization commenced. My duties were to sit in the office of the Assistant Director of Medical Services and supervise the mobilization of the two field ambulances of the two "Irish Brigades," the third field ambulance was being mobilized in England. I also slept in the office each night to be on the spot in case of sudden orders to move. A field ambulance does not exist in peace times. The organization, personnel, equipment, transport, etc., exist on paper during peace, and the unit comes to life only during war. Consequently, it is a new, raw unit, and has to shake down and find its own feet, so to speak. The transport was the greatest difficulty; raw untrained horses were handed over to the field ambulance commanders, and they had to get them broken into harness work. What it means in practice is that the Royal Army Service Corps personnel attached to the field ambulance do their best with indif-

ferent material. It also means that the Royal Army Service Corps do not send their best N.C.O.'s and men to the field ambulances, nor do they, the field ambulances, get the best horses. Consequently, the early days of mobilization for the field ambulances was rather like a circus show; horses plunging about, and refusing to be put into harness, much less be yoked into the cumbersome ambulances. One team elected to bolt, galloped down a steep hill and ended up by smashing in the window of the army pay office. The incident might have been farcical but for the poor driver who was flung off and had his leg broken, the first casualty in the division!

Sudden orders arrived for the Divisional Headquarters to entrain for Queenstown and embark in the S.S. Something—I cannot remember the name. We embarked in the evening on a very large ship, completely swept of all the amenities of civilian life, empty cabins, no bedding, no stewards, empty saloon, no food, no cooks, no nothing save the ship's officers to navigate her. The only thing available was hot water from the engine room. We made up our own mess at one of the saloon tables, and produced our own mess hampers containing plates, knives, forks, etc. and a supply of tinned food. One strange thing was that this immense ship, empty of all the superfluities of comfortable life, bare as a bone, instantaneously became alive with fleas and we were bitten to blazes all night!

We disembarked at Liverpool. In the gloom of dawn we made our way to the Station Hotel and asked for food. We were at first indignantly refused by the staff; the idea of coming to an hotel at 5 in the morning and asking for food! Preposterous! Breakfast would be ready at 8 a.m., until then we could sit in a gloomy lounge and make the best of it. But our D.A.A.G. was a man of a commanding presence. He arose and demanded the manager at 5 o'clock in the morning! The manager came, and in his train came hot coffee, tea, food, everything we wanted. He at once appreciated the situation and acted accordingly. I have no doubt he became a major-general in charge of administration before the war ended!

We entrained for a destination unknown. Of course we knew it must be Dover, Folkestone or Southampton. But an enterprising member of the mess made advances of friendship to the engine driver, who casually told him we were going to Cambridge! And to our wonderment so it happened. We found ourselves settled down at Cambridge, and the divisional troops pouring in on all sides of us.

I soon found my work was well in hand. A brigade of troops was just dumped down in one of those pleasant little open spaces of green sward in Cambridge that are called "commons" or "pieces."

So now arose the strange situation of some 10,000 men camped on small sites in the centre of a city. Some casual sanitary arrangements had been made, but it was soon evident that something more than a few trenches would be required. A bucket removal system had to be started, and started in a hurry. I ran about with the Municipal Authorities, and we made a commencement by ordering many thousands of what are known

as latrine pails from a contractor. All was arranged and next day I saw lorries passing through the town laden down with horrible little garden buckets, about as much use for the purpose as tea cups! But there it was, and we had to carry on somehow.

This all sounds a fuss about nothing, but let any Municipality try the experiment of camping thousands of men semi-permanently in the centre of their towns, and find out what complications will arise. The weather was extremely hot, and Cambridge was looking its best, but we were all restless and unsettled. What were we going to do in the Great War? Was it to be our fate to remain in England as the last regular troops to defend the East Coast against a German invasion? Rumours went to and fro, but we knew nothing.

Wounded arrived from France, and I spoke to officers and men who had been through the great retreat from Mons. They had not much to say, they seemed dazed from their experiences, and just wanted to sleep, and sleep again.

A strange financial anomaly became rather insistent. As officers on active service, we found our allowances ceased. In peace time we drew certain allowances for providing our families with lodgings, house, or whatever it might be. Now we were at war, our family claims were overlooked, and we found ourselves much poorer. The Staff were staying at an expensive hotel, and I found my hotel bills swamped my pay, though I had a house on my hands and rent to pay. So I moved out of the hotel, took some rooms on Parker's Piece, and wired my wife to give up the house in Cork and join me in Cambridge. She did so, and we had a few domestic weeks in comparative peace. I should add that this matter of allowances for families was put right later on, but it was a fact that all officers found themselves poorer men for the first few months of the war.

The orders came at last, and at a few hours notice we were entrained for Southampton. This time no imposing ocean liner received us we were packed tight on a small cross-Channel boat, and headed for St. Nazaire. All heavy baggage, such as our sleeping valises which contained all one's worldly belongings, were dumped in the bowels of the ship. I had retained a covered basin, Indian fashion, into which I shoved my shaving and washing materials, a pair of pyjamas, and a pair of soft slippers. Luckily for me, as it proved later, for on arrival at St. Nazaire we were quickly disembarked and rushed to the station. There we found a special train scheduled to take us to the front. Disembarkation of the baggage was slow, and the French railway staff officer was getting impatient. The train must go to time, baggage or no baggage. The Staff remonstrated, but the Frenchman was adamant. So off we went to the war in the clothes we wore and not a blessed thing extra.

I rather imagine the A.D.C. had been wise enough to smuggle along some suit cases for the G.O.C., but we ordinary mortals were dependent on our valises. My chief had brought a Burberry mackintosh; that was his complete kit. Others in our mess, including the A.P.M., had nothing

at all. Well, it was early September, and warm weather, so we carried on all right. My washing basin was an enormous comfort, and the shaving tackle went round. We seemed to meander slowly through France. At various points we saw train-loads of French wounded, not hospital trains, but ordinary passenger trains, filled with wounded men. They all looked dusty, dirty, worn out, and, to our eyes, these soldiers in soiled blue overcoats and red trousers, were somehow out of keeping with our ideas of khaki-clad fighting men.

To our carriage was introduced a French interpreter. He was a small man, bearded and black of eye, vivacious and talkative. His whole impedimenta consisted of a small cardboard box containing the materials for blacking his boots. Each night he folded the cape of his great-coat over his head and slept. Each morning he threw off the cape, was brightly awake, took down his little box, polished his boots, and *voila*, ready for the day.

I have somewhat hazy recollections of arriving at Coulommiers, of spending a very wet day and night in a barn, of the A.P.M. returning at night soaked to the skin, of him stripping to the buff, and burrowing into the straw the while his clothes were being dried at the fire. I know we spent a night in the house of a notary at Coulommiers. I remember the well-stocked library, and the confusion of the well-furnished house as the Germans had left it. I also remember the Frenchman who showed us the grave of a German soldier, and how he tramped on it, and spat on it, and when we remonstrated told us his brother's wife had been raped by Uhlans in her own house, and how the Germans tied the husband to the foot of the bed so that he could see his own wife being violated.

Best to forget these things, but idle to think such stories will die out of one's memories. Idle to think war will evoke anything but the most brutal of all forms of madness, but also idle to think war is a thing of the past.

I think our lost kit turned up at Bazoches, and that was the most important event to all of us. We were able to have a wash all over, and change our shirts.

At Serches we came to a comparative standstill, and commenced to collect ourselves. We were in France, engaged in the Great War, but so far we had done nothing but follow up the tracks of the advancing allies, and the retreating Germans from the Marne to the Aisne. One saw the ever-present litter of the retreat, broken equipment, water bottles, abandoned vehicles, rags of clothing, and the frequent solitary grave, with the bayonet stuck in the ground and the cap or kepi on it.

We camped on ground that had been twice occupied before us, and, as a sanitarian, I shuddered at the sight. The long-taught hygiene of the British Army was forgotten. Whatever troops went before us fouled everything to such an extent that it was impossible to do anything to clear up during the short time we bivouacked. If ever there was the danger of the whole Expeditionary Force going down with enteric fever, there it existed in September, 1914. Filth, heat, dust everywhere, contaminated

drinking water everywhere, men's resistance lowered by exhaustion and spasmodic feeding, sometimes enough, and again, almost starvation. Everything ripe for disease and it did not come. If anything saved us, it was our system of anti-enteric inoculation. At Cambridge we had worked hard to get 100 per cent of the troops through the double inoculation, and it *was* practically that. The three weeks' grace in England gave us a good chance, and we took it. The G.O.C. and Staff backed us up, and gave us all their help and encouragement, and it paid them well.

At Serches I was able to get at my books, and make a start with my diary, which I did not commence until October 2, 1914. From then until March, 1916, I put down something every day; sometimes interesting, sometimes terribly dull. I forgot to mention one thing. On our train journey from Cork to Queenstown, the box containing all the SECRET maps of Northern France and Belgium fell off the train, and the maps were scattered all along the line. I know hurried search parties were sent out to fish them up again. Well, after all, it was rather typical; we couldn't leave Ireland without some little occurrence not quite in the regular course of circumstances. The last words I had in Cork on the subject of the war were with a solemn, swarthy man who kept a motor business.

"Sir," said he, "this war was inevitable; and why? Because the German Emperor is the corner-boy of Europe, and must be beaten to teach him manners."

Serches, October 3, 1914.

Has quite pleasant memories. We sat down in this little place for a week, as a Divisional Headquarters only. Our brigades had been taken from us to help other divisions in the fighting on the Aisne. As far as I was concerned I did nothing, or next to nothing. I lived in No. 3 mess with my old man, the Assistant Director of Medical Services. The other members of the mess were the A.P.M., the divisional paymaster, and a Cambridge don taken on as an interpreter. A Divisional Headquarters is made up of three messes: No. 1 is the G.O.C.'s own mess, with his A.D.C., G.S.O.1, and probably the A.A. and Q.M.G. No. 2 mess contains the more junior "G" and "Q" people, and No. 3 the rag-tag and bob-tail. Why a G.O.C. cannot have one mess, I could not make out. I believe some G.O.C.'s did. Anyway, there we were in No. 3 outfit at Serches, and the A.D.C. who did the billeting had put us in the Artists' Cottage in the chateau grounds. Nos. 1 and 2 messes were in the chateau. The Artists' Cottage was a barn. The upper floor had been used as a studio, and several little rooms had been partitioned off. The lower, or ground floor, had nothing in it but old rubbish, including a flat-bottomed boat for use on the lake in the grounds. The mess servants fixed up a sort of kitchen on the upper floor, and we all slept there on beds made of hay, with our valises spread out on top. My old man had a little room to himself. The weather was pleasant, and we made a sort of picnic of it; but all the same, I resented the A.D.C. giving us this shanty when the rest of the headquarters were comfortably housed in the bedrooms of the chateau. The G.O.C. was a

charming man, but he never thought of taking a walk over to see how No. 3 mess was getting on. As I say, we had nothing to do, all three brigades were away from us, and we were stranded until such time as the division could get together again. Of course the General was sick at being in such a position, but he could do nothing.

The A.P.M. kept us amused by the earnestness of his spy campaign. The first spy captured was a French countryman of apparently unbalanced mentality, who was found wandering along the road. The A.P.M.'s myrmidons pounced on him and brought him along to the A.P.M. Some little difficulty arose as none of the A.P.M.'s staff, including himself, spoke French, and our Cambridge don had gone off for the day on some quest of the "Q" people. On searching the malefactor his pockets were found full of torn up bits of paper. I was convinced the man was just a village softy wandering about, but the provost would have none of that. Dammit all, it was his first spy in his first war after twenty years' service! To our surprise the paymaster offered to cross-question this spy. It was very funny. All old Boxan could get out was "Quel est la utilité?" This, to discover why the tramp had all this torn up paper on him. I propounded a reason, but it was not accepted. So after a solemn investigation the spy was removed down the ladder to our ground floor, now occupied by the A.P.M.'s policemen, and as no lock-up existed, the half-wit was solemnly seated on one of the thwarts of the boat and chained to it by the boat's mooring chain! At night we heard below us the ghostly rattling of the chain. What became of the spy I do not remember. Much correspondence passed to Corps on the subject. For all I know he became a Sergeant Grischa.

But our greatest excitement was the capture of the Uhlan. In the advance from the Marne to the Aisne of the Allies, the Germans retired behind a cavalry screen, consequently some of their cavalry got left behind, lost their way, horses shot or foundered, or some reason or another. The French population gave them short shrift if they fell into their hands, so many of them hid in the woods, and kept hid as long as they could do so. What happened was the outcome of a visit to Paris of the paymaster. He, plutocrat that he was, had been supplied with a touring car to do his financial work, and rolling along back from Paris was considerably surprised and not a little alarmed to be held up on a road passing through dense woods by a real live German cavalry soldier, Uhlan, complete with lance. The poor devil was exhausted by exposure and hunger, and desperately anxious to be taken by the British. He staggered out on the road holding up his hands. The paymaster's servant, carrying his rifle, acted as escort on these motor trips. He covered the enemy while Boxan descended from the car to accept the surrender. The Uhlan was parked in the back seat with the trusty servant as guard, Boxan sat beside the driver carrying the lance, and so they triumphantly returned to Headquarters.

I hope the prisoner was not also chained to the boat by the A.P.M. I do not think so.

18

I found that we were very short of disinfectants for sanitary purposes, so I proposed to my chief that I should ride into the French lines and see what I could get. I rode over to Fismes and at once found myself back in 1870. The little town was packed with troops in the picturesque old uniforms of the French Army. Infantry in blue great-coats with the flaps looped back and the baggy red trousers, cavalry wearing dark blue with brass helmets and sweeping horse-hair plumes, artillery officers in pale blue double-breasted tunics and round silver buttons, Moroccan horsemen in long dirty-white burnous, Algerians wearing the red fez, all sorts and conditions of soldiers in costumes entirely unsuited for active service. I noticed the cavalry carried short carbines, not much use against modern rifle fire! I looked about for a medical unit of some sort; finally I accosted a brilliant figure in blue and silver, a gunner officer, and he most politely accompanied me to a building in the Grand Place being used as a hospital. He even went so far as to take me inside and hand me over to a medical officer with instructions that I should be accommodated with anything I wanted. The medical officer was equally polite and obliging, he showed me over the place. My mind went back to pictures I had seen in a book at home, of wounded being attended to during the 1870 campaign. The rooms in this building were crammed with wounded. It was explained to me that they were the most seriously wounded who could not as yet be evacuated further back. They lay in beds touching one another on either side of them, heavily overcrowded, serious cases all, and the stink of putrefaction was overwhelming. Horrible wounds suppurating freely, amputation stumps septic. I saw the doctors working in their soiled blue uniforms. One was dressing an amputation stump with wads of tow. I can only describe the place as the crudest effort of medical aid I ever saw. Conditions in the South African War were fifty years in advance of this jumble of smashed humanity, evidently in want of everything that my training expected to find. To come here and ask for disinfectants! I do not suppose they had one thousandth part of what they required, but all the same I was presented with a six-ounce bottle of carbolic acid. I felt ashamed to take it, but the medical officer was insistent, and I could not refuse. And so I rode back to Serches completely convinced that France was as unprepared for this war as she had been in 1870. A few days later I mentioned my experience to our G.S.O.1.

"Don't you know," he said, "that we all realize we have backed the wrong horse."

I see in my diary a great event happened on October 5, 1914. "One motor ambulance received for the division." You must realize that we went into a European War with horsed ambulances, clumsy lumbering wagons drawn by two horses, precisely the same as we used in the South African Campaign. Now we had one motor ambulance for 20,000 men! However, it was on the right side. Incidentally the army doctors had for years fought for motor transport, but Finance said "no."

Villers-Etelon, October 6, 1914.

On the move now, and busy getting two of the three Divisional Field Ambulances collected for entrainment.

Vez, October 8, 1914.

Had a very nice little billet in the gardener's cottage, extremely attractive little maid looked after my room. I had visions of a war-time intrigue, but I seemed too busy to prepare any plans of advancement, and so died my one war romance in its bud, it never bloomed again in Flanders!

St. Saveur, October 9, 1914.

Here we, the Divisional Headquarters, entrained for destination unknown. The two field ambulances had already entrained and gone.

St. Omer, October 10, 1914.

Divisional Headquarters arrived at noon. We were billeted in a monastic establishment. Sad-looking dormitories now occupied by licentious soldiery, i.e., two doctors, a paymaster, A.P.M. and Cambridge Don interpreter. We stayed two days in this uninteresting town, soon to become the Headquarters of the British Expeditionary Force. I can't remember much about it.

Hazebrouck, October 13, 1914.

Arrived late at night by route march and could not find the A.D.C. who was doing billeting officer. I may mention that young officer spent his energies on the G.O.C. and Nos. 1 and 2 mess; having settled them properly he didn't worry about poor old No. 3. But we scored by having the interpreter with us and he found us a pleasant lodging in an *épicerie*.

Pradelles, October 14, 1914.

This scrawl comes to life now with the word, "troops came into action." Established a dressing station in the church and school. Entries appear in the diary from 12 noon to 10.15 p.m. giving details of various orders issued to the field ambulances as to collection and disposal of wounded. The work went on during the night and the last entry on October 15, 1914, says: "Wounded evacuated as shown in appendix. Officers 8, other ranks 238." Quite a little battle. Saw my first German wounded here; they were Saxons, and it gave me quite a shock to see how like our own fellows they were, fair blue-eyed boys, might have been Hampshires or West Kents, or a dozen other County regiments.

Bailleul, October 15, 1914.

Oh yes! But we had a little adventure on the march from Pradelles. It was this way. We were following up a German cavalry screen. They were none too certain of our strength and I expect we were just as vague about them. At any rate the Divisional Headquarters were marching along peacefully, fully convinced that the advancing infantry brigades in front of us were clearing up any opposition. I should explain that a Divisional Headquarters on the march is quite an unwieldy procession of baggage wagons, mess wagons, water carts, odds and ends of all sorts, takes up

quite a lot of room and is singularly inoffensive; servants, cooks, clerks, etc., carry their weapons of war, but the last thing they expect is to be asked to use them. Well, there we were, marching quietly along a narrow road, shut in by hedges. Suddenly a field gun banged very close to us and a shell screamed over to burst in the adjoining field. The column was struck dumb at this unexpected attack and automatically halted. Another bang and another shell in the field. It was getting dark and we were immobilized in the narrow lane, could not turn round and run if we wanted, unless we all bolted on foot or horse and deserted the baggage. Urgent orders to halt came along; we *had* halted, but we had to be told so. Next low-voiced "pass it along" orders to stand quiet, not speak and no smoking. Quiet, speechless and smokeless, we waited developments. Presently the C.R.E. came along and delivered whispered orders to the gunner staff officer in this wise: "Get all servants, cooks, clerks, etc., collected and see they have rifles and ammunition. Get them to line the hedge on the right hand side of the lane and wait further orders." So it was to be, and the Gunner Major having listened patiently to these *sotto voce* instructions, yelled in a loud voice, "Serjeant Major," who replied as loudly, "Sir." The C.R.E. sprang upon them both and implored silence. "German horse battery within 600 yards. Shell us all to hell, for God's sake quiet," etc. With a subdued shuffing the gallant army was collected and lined the hedge to repel the enemy. Darker and darker it got, not a sound, no more shells, all quiet. Suddenly the toot-toot of a motor-cycle, and a blaze of headlight. Along the fatal road comes a signals private, blissfully unaware of any war whatever. Sibilant hissing of "put out that light." Again stillness and darkness. Another double beam of headlights this time, and slowly advances the divisional paymaster in his magnificent saloon car, lately acquired, himself sitting within with his roof lights burning bright and his noble self industriously studying his ledgers. At once he was stricken to inky darkness. Next move consisted in orders to send our covering troops through the hedge and work forward in the direction of the gun that had been shelling us. This was done, and a few minutes afterwards we heard a hoarse cheer, as the brave fellows charged the hostile gun, if it was still there. Soon we came to life and moved on. Sequel to this story is that a few days afterwards I was telling the yarn when an infantry captain who was present intervened with, "So you were the people who charged my company the other night."

Pressed for details he explained that on that particular night he had posted his outposts for the night, settled the company down, and was in a cottage, he had taken as a billet, when his servant, who was in the act of getting him some tea, stopped to listen to some cheering close by, and then bolted out to see what it was all about. The servant returned in a few moments to report, "Crowd of cooks and such riff-raff a-charging the hedge at the back of the cottage. Said they thought there was a Boche gun here. Balmy I calls them." And so ended the perils of the Divisional Headquarters. It was subsequently found that a German Horse Battery was retiring and hearing the rumble of our wagons probably took us for a

large column of troops, fired off a couple of shots for luck, and made off. One small episode occurred before we reached Bailleul that night. The A.D.C. doing billeting officer went on ahead by car, the Divisional General's car, to find billets for the staff. He undoubtedly lost his way, wandering on, found himself on the outskirts of a small village. Being uncertain of where he was he told the driver to stop, got out and walked towards the nearest houses, to walk straight into an unfriendly rattle of hostile rifle fire. He nipped round and ran like a hare for the car. The driver was quick enough to turn at once when he heard the rifle fire, so FitzMaurice was able to dive into the car and get back with nothing worse than a bullet through his forearm. When he got back to the column, and somewhat excitedly explained to the General his adventures, the G.O.C., not seeing the safely returned car, interrupted the tale with, "Good Lord, you fool, have you lost my car!"

Steenwerck, October 16, 1914.

We arrived at this small town late at night. The division was slowly advancing against a stiffening opposition, and fighting was going on daily now. I well remember Steenwerck as the place where the dashing German Uhlan escaped. I was walking towards the Hotel de Ville, where headquarters had established themselves, when a sudden burst of rifle fire broke out. I saw infantry standing all round the building with rifles at the ready and occasionally putting a bullet through an upper window. Just then a signal was made by an officer from a lower window that all was clear, and to cease firing. I was told that a German soldier had suddenly dashed down the stairs of the Hotel de Ville, through corridors and landings full of headquarter clerks passing to and fro, flung himself down the steps, jumped for the horses standing hitched to the post at the entrance, was up and galloping hell for leather out of the town before surprised sentries could get a shot at him. It was a real romantic effort, and I hope he got away safely. Obviously he had stayed behind for some reason, and hid himself in one of the top rooms of the Town Hall. Then, seeing the town full of British troops, he decided to make a dash for it, and the sight of the staff officers' chargers, all hitched up ready for him, decided him on his plucky attempt. Rumour had it that in the German's hurried flight down the stairs he collided with the portly G.S.O.1, coming up, and the latter was found doubled up in a corner, completely winded, and convinced that he had been struck by a very large shell.

Fleurbaix, October 17, 1914.

Rather a nice village. Billeted in the mayor's house, he having presumably departed before the Germans arrived. I know I had quite a palatial bedroom, with cool, clean, but rumpled linen ; in fact, the bed was as the German officer had left it that morning. The fire-place and the floor were well stocked with cigarette stubs, all Egyptian and gold-tipped. A nice collection of empty champagne bottles stood about, or rolled about, on the floor. Evidently my predecessor had done himself well. However, I was not put out by this evidence of former enemy occupation, and I tumbled into that bed with the utmost satisfaction. It was the first bed

I had struck since leaving England, and I thoroughly enjoyed it. I found out afterwards that the headquarters of a Boche cavalry division had occupied Fleurbaix for some days. We arrived late on the night of October 17, 1914, as may be gathered from my description of the bed and bedroom. Incidentally, we were very busy now; continual fighting was going on, and the evacuation of wounded was going forward constantly. I see by the diary that various events went on from the morning of October 18, 1914, to the hour of 2 a.m. next morning, comprising orders and moves of the field ambulances, visits to the advanced dressing stations, communications with D.D.M.S. of the Corps as to disposal of casualties, and the usual hundred and one affairs that have to be dealt with during a fight. We stayed in Fleurbaix until October 23, 1914, and the fighting accounted for 1,000 wounded. Several alarms and excursions occurred. One was the presence in our mess for the best part of a day of a German officer prisoner. For some reason the Staff thought it would be a very deep game to plant this Berlin solicitor of the Reserve of Officers on us, so that our Don interpreter could gain much knowledge from him. All I know is we fed him and gave him drinks all the day, and I, personally, got very tired of having the chap hanging about. He said one very sensible thing. Asked how long the war would last, he at once replied, "Three years," and added "and of course *we* shall win." The first part of his reply was the earliest intimation we had heard from the other side as to their ideas of duration of the war. When it was considered this gentleman had been pumped dry, he was handed over to the A.P.M.'s myrmidons for removal to the Corps Headquarters. As soon as he appeared in the street, the local inhabitants made a determined attack upon him. They were so savage that the provost serjeant had to knock out a few villagers with the butt end of his revolver. If they could have got at him, they would have torn him to ribbons.

Another event was the arrival at 11 p.m. on the 20th of Major Smith, of the 18th Field Ambulance, to report that the Brigade Commander considered the situation at Rue du Bois dangerous, heavy German attacks were being made on that thin British line, no reinforcements were available and an enemy break-through was feared. The field ambulance had 250 wounded and wanted help quickly to get them away. I went upstairs to see my "old man" about it. He sat up in bed, listened somewhat drowsily, and gave me instructions in the famous words, "Carry on." So saying, he turned himself over in bed and returned to his interrupted slumbers. I went down the village street to the "Q" office and got them busy at ordering the R.A.S.C. to rush up G.S. wagons to Rue du Bois. I pushed off myself to see how things were doing, and sure enough found signs of a "crack" coming. Met infantry soldiers dribbling back, and was told in the language of men with the "wind up" that "the Boche were coming on in thousands." By 6 a.m. the wounded were all gone, and the field ambulance moved back to Fleurbaix. As it happened, the line held all right, thin as it was, and the old Army shot so well that the Germans subsequently reported being held up by innumerable machine guns. At

this stage of the war battalions had only two machine guns! It became unhealthy in Fleurbaix. The field ambulance was shelled, had casualties amongst the R.A.M.C. men, and it was soon no place for the wounded. All three field ambulances were moved further back. I think it was the same day they moved that I saw our G.S.O.1, a portly and commanding figure of a man, chased down the village street by shell fire. He happened to be out for a little stroll, and was walking back to his office, when the first shell dropped some thirty yards behind him. All the common folk retired into the houses or doorways, some sort of shelter. The G.S.O.1 continued his stately progress unperturbed. The next shell was about twenty yards behind him, but still he did not even increase his pace. The next a shade nearer, but by now he was at the door of his office. Magnificently he stopped, turned round, looked up the street as if to say, "Dear me, some shells have been falling, what?" and slowly stepped inside the door of his house. I bet old Bill was damned glad to get out of that street, but he made a great impression on the village. It continued to be unhealthy, in fact, it rapidly became a dangerous place to locate the brains of the division, and signs of a move were indicated. The actual move was not without its amusing side. I came back from a visit to the advanced dressing stations to find the divisional transport rumbling down the street. It was rapidly getting dark, and it was not easy to make out individual figures in the dusk, but I certainly recognized the mounted figure of our No. 2 A.D.C. leading the procession. Next moment I was almost knocked over by my "old man" riding his famous white horse.

"Aren't you coming?" he shot over his shoulder as he passed. At our billet I found my servant waiting for me. "What's all about?" and he told me Divisional Headquarters were moving, No. 3 mess had indeed gone, and my kit had gone with it. He himself was due to start at once. I thought this was all a bit sudden, but there it was, we were off! I joined in and rode down the street in the dark. Passing the "G" office, I saw lights in the windows and pulled up to make inquiries. There I found the G.S.O.2 and the D.A.Q.M.G. sitting in solitary state, or rather, the "G" officer was lying on the floor asleep. He had been hard at it for several nights and was pretty well done in from want of sleep, but the "Q" man was wide awake anyhow. I asked for news and was told that the situation was very uncertain, the line was coming back, and Divisional Headquarters were to move in detachments, so to speak. "As far as I am concerned," he went on to say, "I remain here until I hear the guns coming down the street, and then I am off." This sounded very heroic, but it was obviously my job to get along with my own Directorate, so I departed to catch up the column. It was a very dark night and we crept along at a slow pace. After a good deal of twisting and turning about, checking, starting and checking again, halting for periods and spasmodic moves, it became pretty obvious that our destination was vague, or that the A.D.C. had lost his way. After some hours of this we finally halted at a deserted brewery on the Erquinghem Road, and settled down for the night. No. 3 mess pitched itself in the manager's office, quite a palatial place it was, and the cook

scratched up a meal of sorts. We were just turning in when a signal man arrived on his motor bike and delivered a letter to the A.D.C. The gist of the communication was, "situation stabilized, return to Fleurbaix." We did so next morning, and the next morning we once more packed up and moved to a little village on the Lys called Croix du Bac. We billeted in an empty shop cum private residence. The big front room had a counter and shelving on the walls filled with cardboard boxes containing all sorts and conditions of female habiliments. The servants moved the counter away somewhere and fixed up a trestle table of sorts as the mess dining and ante-room. For a great treat we had separate bedrooms; mine was at the back looking out on the little garden, and, I am sorry to say, overlooking that sanitary contrivance that the French use for domestic purposes, and at times, for agricultural pursuits as well. But come, come, one must not be squeamish in a war book these days, call it the cesspool closet and have done with it for good and all. In some recent war literature I have found pages of minute descriptions of latrines, I suppose to show plainly the horrors of war, and in a quite recent book (American) the hero talks freely with his V.A.D. mistress about the various kinds of venereal diseases he suffered from in the sad, bad days before they met in love's young dream, and she says, "Poor darling, did it hurt you much?" He replies "sure."

Excuse this divergence from a plain unvarnished tale of a war. No. 3 mess was now increased by the addition of another interpreter, one who could talk French without a Cambridge accent! The latest addition was a subaltern in the R.A. Militia, and a Consular officer as well. He was cosmopolitan, amusing, independent and free and easy in his ways. The first night at dinner he established himself by saying to the mess waiter who had forgotten to give him a spoon with soup: "I say, can I have a sponge or something to eat this soup with?" Why we did not have Frenchmen as interpreters I do not know. It was very early in the war and I presume France had nobody to spare at the time. A singular sort of war peace now settled down over our part of the line, I mean the kind of peace that read "All quiet on the Lys sector" in the *Daily Mail*, but from my diary it settled into a daily list of wounded and sick evacuated to the C.C.S. at Bailleul. But the peace was broken on the 24th, 25th and 26th by determined enemy attacks and casualties mounted to thirty-one officers and 627 other ranks. During this period we had two medical officers killed and two badly wounded. In the diary appears "Instructions issued that no sick to be sent back by Supply Column"; that, I think, ended the old established ritual, strongly opposed by the R.A.M.C. and the R.A.S.C., that sick and wounded could be returned to nearest railhead by the returning empty supply waggons. Another interesting entry is, "Cases of self-inflicted injuries, gun-shot wounds of fingers, hands, etc., are to be returned with the unit and treated by the regimental M.O." First direct evidence of the mental strain of this so great war, and yet in its infancy! Again we settled down to a "peace war," but a significant entry on November 5, 1914, reads, "Casualties up to date, officers 53 and other ranks 2,114."

The dreaded scourge of armies, typhoid fever, commenced to show itself. The first case reported was on November 4, 1914. But we were not intimidated, the division had been well and truly inoculated against the disease before we left England, and our system of careful investigation of each case helped to keep the men free of it. You will understand that the disease itself was diagnosed by the microscope and cultural tests in the, at this stage of the war, stationary and general hospitals further back. Once the diagnosis was settled the information was wired to the divisions concerned. Immediate investigation of the circumstances of the individual was then made. Did he live in trenches? If so, what dug-out? Who were his companions in the dug-out? Did any of them give a history pointing to a possible carrier? Where did the drinking water come from? etc. So from a microscope investigating the results of a culture tube at Boulogne back to the dug-out the sick man came from, the chain was connected, and the cause looked for. I often wondered if the gentleman marking "positive" on the report in his laboratory visualized the other end of the chain, the regimental M.O. toiling up a communication trench from his regimental aid-post to the front line. Squelching along in his muddy gum-boots, cowering down in the trench as shells smashed and fragments whizzed over him, crawling along again to find the something platoon of the something company, and Privates Smith, Jones and Robinson, who shared a dug-out with Private Atkins, now an enteric case at the something hospital at Havre. Well, well, in the next war I will be a scientist, it is a much more comfortable amusement. Another pest of war makes an entry: Detailed instructions how to remove lice from clothing! Reports of M.O.'s of units that methods of removing lice from clothing by heat, asepso soap, lysol, and 1 in 160 cresol solution are being carried out. And then appears a pathetic paragraph: "The main difficulty is that most men have only one shirt; when they are given a clean shirt, they throw away the lousy one!" Somebody said during the war that the only profession that could be thoroughly learned in six months' time by any young man of average intelligence was that of an officer of His Majesty's land forces. Of course this statement is drivel, but I never could understand why an officer seemed unable to keep his men clean, as far as it was possible to do so under the circumstances, without appealing to the medical department to clean his men for him. I know the combatant officer had a devil of a lot to do when fighting was brisk, but when things were quiet he had lots of spare time, and I claim he should have devoted more attention to such matters. In justice I admit it all came later on in the war, but in the early days it was thought the proper thing to leave the care of the men's bodies, feet inspections, V.D. inspections, lice inspections, itch inspections to the M.O. Any subaltern could be taught to do most of these routine affairs in half an hour. And so it fell to the doctors to start the first regular system of improvized bathing and de-lousing establishments, and employ the R.A.M.C. trained personnel on this work. All wrong, of course, but somebody had to do it. So we took over an empty brewery at Bac St. Maur, had the huge vats cleaned out, laid in stocks of soap, towels, and

underclothing, employed a staff of Flemish women to act as washer-women, and to run hot irons over the seams of khaki tunics and trousers. All was soon functioning, and battalions out of the line were marched down in companies, washed, de-loused, and fitted out with clean underclothing. The same time we were doing this with improvized arrangements, those backward Russians were running their completely equipped disinfecting and de-lousing trains close up to the front line trenches, and washing, steam-disinfecting, and re-clothing their soldiers. The English start slowly and finish well.

On November 14, 1914, I attended the final scenes of the shooting of a spy. The A.P.M. asked me to provide a medical officer, and I told him I could come along myself. The man was a Flemish peasant. He had been seen by his village acquaintances to be very friendly with the Germans during their occupation of Croix du Bac, and was suspect. After the departure of the enemy he seemed very flush of money, and was observed to move about at night time without any definite object. He was watched, and finally caught red-handed cutting our telephone wires. The Court Martial was held, and the sentence was death. The execution was staged at 7 a.m., in the courtyard behind the house used by the A.P.M. as the divisional jail. For some political reason the Maire of each adjacent village was ordered to attend. Against the wall of the yard stood a single apple tree. At the appointed time, the wretched man was led forth from his prison room by the escort. He was weeping and wailing loudly, but he insisted in saying farewell to all these solemn French gentlemen in sombre black frock-coats. To each he gave an embrace and a kiss on each cheek. One alone, the Maire of his own village, repulsed him and would have none of his kisses. The man howled and screamed as they blindfolded him and led him towards the fateful apple tree, to which they bound him. The firing squad were palpably nervous, and disliking this ignoble duty. The A.P.M. was shaking with nervousness. A bit of paper was pinned over the man's heart to give the shooters something definite to aim at. All now stood back and the A.P.M. dropped his handkerchief as a signal to fire. The shots rang out and the victim drooped forward in his bonds, but still alive and breathing. The A.P.M. asked me in an agitated voice, "Is he dead?" I said, "no, fire again." I could see by the officer's shaking hand that the *coup de grace* from his revolver was out of the question. Once more the rifles pointed and belched fire. This time there was no mistake. They cut him loose and the body sprawled loosely on the ground. I turned him over and saw that his back ribs were blown out in great wounds. In that wonderful book, "The Case of Sergeant Grischa" the account of his execution is a great bit of writing, but an error is made when it describes the small bullet holes in his back. Firing high velocity bullets into a human body at a few yards range bursts and tears in one explosive smash. As we left the yard I saw the village curé bending over that sodden heap of pulped flesh and blood. I never again offered to attend the shooting of anybody.

(*To be continued.*)

MALARIA AND ITS TREATMENT.[1]

By Major A. G. BIGGAM, O.B.E.,
Royal Army Medical Corps.

Malaria derives its name from the two Italian words *mal* (bad) and *aria* (air), as it was believed that the disease was produced by the inhalation of poisonous emanations which rise from the ground, especially in marshy places. The discovery of the malarial parasite by Laveran in 1880, and its life cycle in the anopheles mosquito by Ross in 1898, made the nature of the disease no longer a mystery and gave indications of how efficient measures of prevention might be instituted. Unfortunately, despite full knowledge of the nature of the disease and its mode of spread, malaria in the tropics still remains responsible for a greater number of deaths and for far more disability than any other disease.

Before proceeding to consider the treatment of malaria a few points regarding its symptoms and difficulties in diagnosis might be of interest. The typical attack of malaria comes on every second or third day, and consists of a cold stage followed after half an hour by a more prolonged hot stage, terminating in a sweating stage, during which the fever drops and the patient becomes comfortable again until a further attack comes on. Unfortunately the history of an attack is often not typical and so cannot always be relied on to assist one in arriving at the diagnosis; not infrequently the attack comes on quite irregularly with fever of almost any variety, the correct diagnosis only being made by suspecting its malarial nature and carrying out blood-smear examinations for the detection of the malaria parasite. Even careful blood examination, especially in malignant malaria, may fail to demonstrate the specific parasite owing to the small size of the rings, and more especially to the fact that only the very early stage of the asexual cycle of this type of malarial parasite is found in the peripheral circulation, the amœboid forms disappearing into the deep tissues and thus not being found on blood-smear examination.

I have repeatedly seen cases of subtertian malaria with irregular temperature, or even no temperature at all, suffering from ill-health and anæmia for long periods, the malarial nature of the affection not having been detected owing to the fact that steps had not been taken to procure blood-films at different times during the day, so as to catch the parasite during the short period of its cycle in the peripheral circulation.

A few notes on a series of over 100 cases of malignant malaria cases infected during intravenous heroin administration may be of interest.

These malarial cases occurred mostly during the summer of 1929; the

---

[1] Post-graduate lecture delivered at the Kasr-el-Aini Hospital, Egypt, on March 7, 1931.

disease was confined entirely to heroin addicts, the parasites being conveyed from man to man by means of malaria-infected blood gaining access to the syringes used during the intravenous heroin injections and so being passed on to other individuals and setting up an active malarial disease in an ever-increasing number of these heroin addicts.

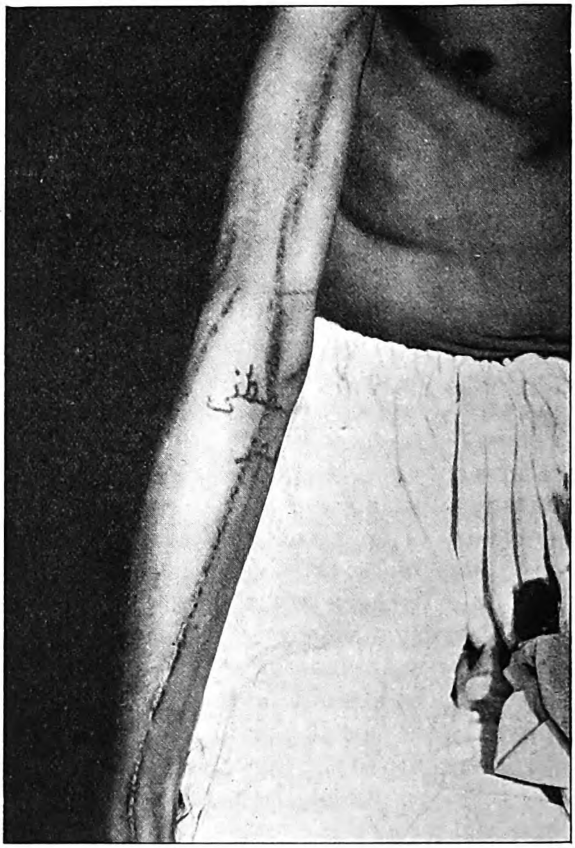


Fig. 1.—The arm of an intravenous heroin addict, who had become infected with subtertian malaria during the administration of the drug, showing pigmentation along the veins resulting from the repeated injections.

History of Quinine and Malaria.

In 1638 Contessa del Cinchon, wife of the Spanish viceroy of Peru, is said to have cured an intermittent fever by the bark of an indigenous tree of Peru ; the bark was then introduced to Europe, the name cinchona being given to it in honour of the Countess. Much confusion, however, existed as to its value because no accurate differentiation could at that time be made between the many varieties of fevers due to different diseases, many of them resembling malarial fever. This difficulty in diagnosis led Torti in

1753 to divide fevers into those that were cured by cinchona and those that were not, this being at that time the best method of differentiating malaria fever from other types of fever.

In 1820 the alkaloid quinine was isolated from cinchona bark and soon came into general use. It has proved to be as effective against malaria as any of the other alkaloids of cinchona, allowing greater accuracy in dosage than was possible with the bark. Quinine still remains the most effective single drug in the treatment of malaria, but many diverse modes of administration and combinations with other recently discovered drugs are now used.

Unfortunately we have no method of determining when a patient is entirely cured of the disease; he may be afebrile and there may be no parasites in his blood for many days after a course of quinine, and yet suddenly, from exposure to cold or strain of any sort, he may go down with an acute relapse of his old disease. This inability to arrive at a diagnosis of cure leads to great confusion as to the optimum course of quinine treatment, and difficulty in assessing the value of new drugs put on the market as cures of malaria.

Quinine should always be given in a soluble form to enable ready absorption to take place from the intestine; the sulphate of quinine therefore should never be given in tablet form, but should be dissolved by the aid of an acid and taken in solution. Complete absorption of such a preparation takes place within six hours of administration and its presence can usually be detected in an unchanged form in the urine within half an hour of administration; this latter fact can be made use of to test whether the quinine given is being absorbed or not. After reaching the blood-stream it is quickly deposited in the liver, spleen, kidneys, etc., and being broken up in these organs is believed to become inert.

The mode of action of quinine is not definitely known, but during or after absorption some change in its composition apparently takes place enabling it to act on the parasites in the blood-stream and destroy them, the resultant product of this destruction perhaps stimulating the defensive mechanism of the body and so enabling it to deal with the remaining parasites.

The usual dose recommended for a fresh infection is ten grains of a soluble salt of quinine or of the sulphate of quinine in solution three times a day for one week, followed by a further week's course of ten grains twice a day; this course can be repeated or modified if relapse occurs. Absorption of the drug is assisted by keeping the bowels well open, so treatment is usually commenced by giving three grains of calomel followed by two to four drams of magnesium sulphate in a small amount of water, and repeating the saline aperient daily if required. Sugar-coated tablets should never be used owing to difficulty in their absorption; but fresh tablets of a soluble salt of quinine, such as the hydrochloride of bihydrochloride, are quite suitable, though more expensive than the quinine sulphate solution.

Sinton discovered that quinine acts better when associated with massive alkaline treatment, and in certain resistant cases very good results have been obtained by this method, large doses of alkalies being given along with the quinine course.

In benign tertian and quartan infection, if the patient is actually in an attack of "ague," the commencement of quinine treatment may, with advantage, be delayed till the termination of the attack, aspirin, the application of heat and hot drinks being employed to hasten the onset of the sweating stage. In subtertian malaria, however, quinine should always be given without delay, as an apparently mild attack may suddenly develop severe complications with coma, convulsions, or acute intestinal symptoms. In fact, malignant malaria cases are as urgent as cases of acute appendicitis and should be treated by the specific drug at the earliest possible moment after diagnosis. One has not infrequently seen a case of malignant malaria, apparently quite well, suddenly fall down unconscious from blockage of the cerebral vessels, and then even the most energetic treatment may be of no avail to save the life of the patient. Cases of malignant malaria, however, once they have been got under the influence of quinine, do not tend to have the troublesome relapses which are sometimes found with the benign tertian and quartan types of infection.

Cases of pregnancy with malarial infection are often given insufficient quinine owing to the fear of inducing abortion, but this is much more likely to occur as a result of withholding quinine than from the administration of adequate doses of the drug, and threatened abortion should be looked upon as a definite indication for quinine treatment, half the usual dose being given twice as often, so that the total administered may be the same as if the patient were not pregnant. Nowadays, plasmoquine may be employed with quinine in the treatment of these cases.

The oral method of administration of quinine is the method of choice, but in certain emergencies other routes may have to be employed; where the infection is due to malignant malaria and complications, cerebral or otherwise, set in, then the patient should be rapidly brought under the influence of the drug by using the intravenous method. As quinine is a cardiac depressant the individual dose should be reduced to 0·5 gramme, diluted in ten cubic centimetres of water, which should be injected slowly. As soon as the emergency is over, the oral route should be again employed. I have known a case where sudden death of the patient occurred almost immediately after intravenous injection of one gramme of quinine, given rapidly, the doctor being under the misapprehension that he was giving only one grain.

Intramuscular administration is occasionally used, but here the rate of absorption is as slow as by the oral route; it is also very irritating locally, and is not devoid of risk owing to the local necrosis so produced being a suitable nidus for the development of tetanus and other bacilli. I have seen more than one case showing resultant nerve lesions due to the injection

having been made close to important nerves, such as the sciatic and musculo-spiral, the paralysis produced by damage to these nerves persisting for very long periods. On investigating the history of two such cases seen in Egypt, there did not appear to have been sufficient reason for the intramuscular route being employed instead of the oral one, no urgent symptoms being present when the quinine was given. If the intramuscular route is selected, one of the safest sites of administration is in the buttocks with the patient seated, so that the area with important nerves, etc., shall be protected from injury.

The subcutaneous route should never be employed, owing to danger of causing sloughing of the superficial tissues in the vicinity.

Real cases of quinine intolerance are very occasionally met with where even such small doses as one grain may cause marked cardiac and other symptoms. I have only met one such case amongst many thousands of cases treated with quinine. Where the patient states that he is intolerant, this statement can be readily verified by the application of a ten per cent. solution of quinine to a scratch on the arm, using normal saline as a control. If he is sensitive the scratch becomes red and swollen within a few minutes of applying the test. If the patient is sensitive, treatment can be commenced by giving $\frac{1}{32}$ of a grain as an initial dose, and doubling the dose every two hours until two grains are being given. Sodium bicarbonate in ten-grain doses should be given along with each dose of quinine.

Ringing in the ears and deafness almost inevitably result from the taking of quinine, and indicate that absorption is taking place. Permanent deafness and blindness, however, have resulted from over-dosage, so excessive doses should be avoided. Quinine amaurosis may occur from a single excessive dose, or, more often, from such doses repeated over a long period, permanent damage to the optic nerve with resultant blindness occurring. I have seen one such case follow soon after the taking of a large quantity of quinine sulphate solution at one draught, the patient having done so to show that he did not mind the taste of the drug.

Euquinine has the advantage with children of being almost tasteless; it is quite an efficient preparation.

Quinine tannate, on the other hand, is insoluble, and therefore not so useful, as it is only slowly absorbed.

Cinchona febrifuge varies markedly in its composition, and many consist of (*a*) all the alkaloids derived from the cinchona bark, or (*b*) residual alkaloids left after quinine has been separated in its manufacture. Its great advantage is its cheapness, but the disadvantage is the uncertainty of its composition and dosage.

Arsenic has been employed for many years in the treatment of malaria, Fowler's solution being the preparation originally used for this purpose. The results obtained are satisfactory in both fresh infections with malaria and in chronic relapsing cases of this disease; in the latter type of case, cures have frequently been brought about by beginning with one drop of

Fowler's solution three times a day, and increasing the amount given by one drop at each dose till ten drops three times a day are being administered; if symptoms of intolerance have appeared, the drug should be discontinued for a fortnight before repeating the course of treatment. During this arsenical treatment of chronic malarial cases ten grains of quinine may be given twice daily with advantage on two consecutive days during each week.

Recently new organic compounds of arsenic have been employed. One of these, stovarsol, has a marked effect in producing a clinical cure in benign tertian malaria, causing the parasites, both sexual and asexual, to disappear from the peripheral circulation. Its action is very much enhanced when given with quinine, and their combined use seems to lessen the tendency to relapse in cases of chronic benign tertian infection. The general condition of the patient under stovarsol treatment usually markedly improves; precautions must, however, be taken to prevent the toxic manifestations which occasionally occur during its administration. Stovarsol seems to have little or no action on the parasites of malignant tertian malaria.

About 1925 plasmoquine, a synthetic derivative of quinoline having a formula resembling quinine was introduced and its effect on malarial parasites investigated. It was found to have a markedly lethal action on the parasites, both sexual and asexual, of benign tertian and quartan infections, but, whilst having a destructive effect on the gametocytes of *Plasmodium falciparum*, it has little or no action on the asexual forms of this parasite, and so does not influence the course of the malignant tertian disease. Another great drawback to plasmoquine is its toxic effect, several deaths having been recorded from its use. The chief toxic symptoms observed were cyanosis, pallor, nausea, gastric pain and hæmoglobinuria. These toxic effects led to the diminution of the dosage of plasmoquine and its use combined with quinine. Since this modification has been carried out, toxic effects have been much less evident. In a recent series of over fifty cases of malignant tertian malaria treated by us in Kasr-el-Aini Hospital with plasmoquine and quinine, careful watch was kept for the appearance of symptoms of toxicity, but in no case were any serious symptoms observed; very occasionally slight discomfort was complained of in the mid-epigastric and splenic region, usually towards the end of the first week's course, but in no case had the course to be modified in any way owing to the appearance of these toxic symptoms. No cyanosis was observed in any of these cases.

Plasmoquine and quinine together are now used extensively in the treatment of malaria, very good results being obtained by this combined treatment, the best route of administration being the oral one. We have employed the intravenous method in a series of cases of malignant malaria, but the results were no better than those obtained by using the oral method. We have found the combined treatment with plasmoquine and quinine, in

doses of plasmoquine 0·04 gramme and quinine 1·2 grammes daily, to be a safe and effective dosage for the treatment of adult patients suffering from malaria; such doses have proved of great value in bringing about a cure in chronic benign tertian malaria and in rapidly clearing the peripheral circulation of both asexual forms and crescents in malignant tertian malaria. In a series of malignant tertian cases observed by us under this course of treatment the average time taken for the crescents to disappear was four and a half days and for rings 3·25 days. The rapid disappearance of crescents compares very favourably with the results previously obtained by quinine alone, when crescents were frequently observed to persist for very long periods, even when the dose of quinine administered had been an adequate one. The persistence of crescents in the peripheral circulation may result in anopheles mosquitoes

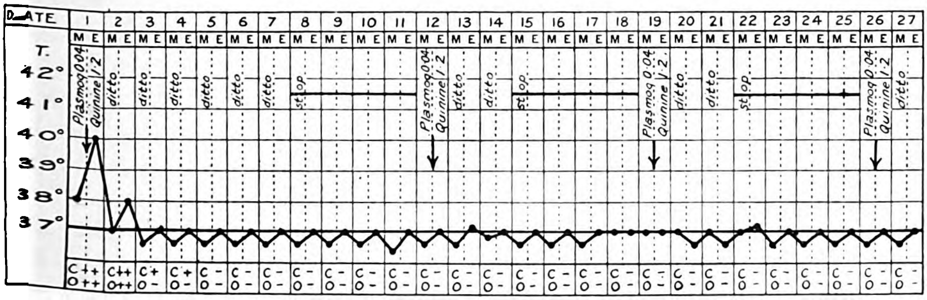


FIG. 2.—Temperature chart of case of subtertian malaria showing course of treatment with plasmoquine 0·04 gramme and quinine 1·2 grammes daily, spread over a period of four weeks: first week, continuous treatment; succeeding three weeks, four days rest and three consecutive days treatment. Effect of treatment on crescents and rings is shown below the record of temperature on the chart.

becoming infected and the disease being carried to other individuals in the vicinity.

A most important observation was made by Barber, Komp and Newman in 1923; they found that mosquitoes fed on human crescent carriers who had received small doses of plasmoquine for short periods of twenty-four to forty-eight hours never became infected, even though crescents were still present in the blood. If these observations are confirmed, this action of plasmoquine in inhibiting the further development of the gametocytes in the mosquitoes may be utilized in areas where human carriers are prevalent, small doses being given to prevent infection of the mosquitoes.

Using daily doses of plasmoquine 0·04 gramme, and quinine 1·2 grammes, given in three divided doses, the best course of treatment is to begin with one week's continuous treatment, this to be followed by four days' rest and three consecutive days' treatment. The interrupted treatment is then repeated till one month's treatment in all has been completed.

We consider the interval at the end of the first week advisable, for it

is at this stage of the treatment that toxic symptoms are most likely to appear, and this break in the treatment allows of recovery from any toxic effects of the drug before the treatment is continued, so as to complete the month's course.

Some observers, however, prefer to carry out continuous treatment with similar doses over a period of twenty days, and state that they have obtained good results from this method of administration.

If only one drug is to be used in the treatment of malaria, quinine is the one of greatest value, and its use will bring about a cure in the great majority of cases of fresh malarial infections.

The oral method of administration is the method of choice, and care should be exercised to ensure that the bowels are kept well prepared for the absorption of quinine by the administration of saline aperients.

Arsenic is of considerable value, employed either at the same time as the quinine treatment or given during convalescence, using Fowler's solution in gradually increasing doses with intervals, or one of the newer organic compounds such as stovarsol.

The employment of plasmoquine with quinine has proved of the greatest value in bringing about a cure, especially in chronic relapsing cases of benign tertian and quartan malaria. This combined treatment has also been of great assistance in malignant tertian cases, owing to its effect in rapidly clearing the peripheral circulation of crescents and inhibiting the further development of these parasites in the anopheles mosquitoes. When given in the smaller doses now recommended and combined with quinine, toxic symptoms are either slight or entirely absent, and we need have no fear in prescribing the drug.

Editorial.

THE FLOCCULATION TEST IN THE DIAGNOSIS OF SMALLPOX.

In an editorial in the April number of the Journal, 1930, we described the results which Dr. Burgess, Medical Officer of Health for the City of Dundee, and Dr. James Craigie and Professor Tulloch had obtained in applying Gordon's flocculation test to material derived from cases of smallpox and other conditions in Dundee. The findings of these observers indicated that the test was specific, and was of considerable use to the clinician. Dr. Craigie and Professor Tulloch, however, were not satisfied that they had found the best method of performing the test and that the influence of the bacteria in the crusts of variola and vaccinia on the specificity of the reaction had been satisfactorily dealt with. They proceeded to make further investigations on the subject, and a report on this work has just been published by the Medical Research Council.

Craigie and Tulloch have now examined 225 specimens of crusts from dermal lesions, of which 195 were from human sources and 30 from other mammalians.

Among the human lesions, 106 were smallpox minor, 14 confluent smallpox, 59 chickenpox, and 7 human vaccinia. Unequivocal positive reactions were obtained with all the vaccinia crusts, all the cases of confluent smallpox, and 103 out of the 106 cases of smallpox minor. The dermal vaccinia strains of bovine, rabbit and guinea-pig origin all gave definite positive reactions.

In addition to the tests carried out with dermal vaccinia, a number of tests were made with antigens consisting of extracts of the internal organs of animals suffering from generalized vaccinia produced experimentally. These extracts also gave positive results, which were of special interest as the extracts were free from bacteria normally present in the dermal crusts, and justified the opinion that the flocculation test is definitely specific.

In their first report Craigie and Tulloch described some experimental work which seemed to show that the flocculation reaction was not caused by the response to the bacteria which had been inoculated with the vaccinia crusts. In the present report they have again attacked the problem in several ways. Indirectly, they have shown that a serum prepared by the inoculation of bacteria cultivated from the crusts in approximately the same number as they exist in the same crusts used to prepare the flocculating serum, failed to cause the production of the antibodies which flocculate extracts from vaccinia crusts. They found that very large numbers of the bacteria, mainly staphylococci, were required to give a visible reaction *in vitro* with homologous anti-staphylococcal serum. These numbers were in excess of those present in the crusts used to

prepare a flocculating serum. A concentration of over 500,000 micro-organisms per cubic centimetre was required to give a visible agglutination with anti-staphylococcal serum. This is much more than would be present in a dilution of 1 in 1,000 or 1 in 2,000 vaccinia extract, and in these and still greater dilutions markedly positive reactions were obtained with anti-vaccinia serum.

Absorption tests were carried out, and it was found that extracts of vaccinia or variola crusts removed the flocculating property from anti-vaccinia serum, but failed to remove the staphylococcal agglutinating antibodies from anti-staphylococcal serum; also absorption with suspensions of secondarily infecting bacteria failed to remove the vaccinia-flocculating properties from anti-vaccinia serum, although such absorption rendered inert the anti-sera to the secondary invaders.

A final direct proof that the micro-organisms in the variola and vaccinia crusts were not the cause of the flocculation test was obtained by employing uncontaminated vaccinia material. Captain Douglas gave Dr. Craigie and Professor Tulloch the brain of a rabbit which had been inoculated with neuro-vaccinia. Some of the rabbits inoculated with this brain virus developed general vaccinia, and the uterus from one of these rabbits was tested by aerobic and anaerobic cultures, which remained sterile after fourteen days' incubation. In addition, male rabbits were inoculated by the intratesticular route with the same virus, and the testicles of one of these when investigated in the same way gave perfectly sterile cultures.

A rabbit was then inoculated with mixed extracts from the uterus and testicle, and the course of immunization was similar to that employed in preparing flocculating serum by the inoculation of dermal lapine. The serum of this rabbit was tested against extracts of both smallpox crusts and rabbit vaccinia crusts. Diluted 1 in 50, the serum flocculated with both extracts, while normal rabbit serum in the same dilution had no effect. The maximum flocculation occurred in the presence of the crust extracts diluted 1 in 2,000. In a dilution of extracts of 1 in 500 there was no flocculation with the smallpox extract and only slight flocculation with the lapine crust extract. Craigie and Tulloch consider this zone reaction to be very important in relation to the technique used for conducting the absorption of antibodies test. The optimum relative proportion of serum and extract should be used, viz., 1 in 2,000 extract to 1 in 50 serum.

The findings were corroborated many times by immunizing animals with sterile, uncontaminated vaccinia material, and showed definitely that the secondarily infecting bacteria were not responsible for the development of the "variola-vaccinia flocculating" quality of the serum. It appeared also that the lesions found in the animals suffering from generalized vaccinia were really lesions due to infection with vaccinia virus, and were not due to secondary infections—e.g., with *B. lepisepticus*—as might be suggested.

Further corroborative evidence was furnished by experiments which established the serological identity of the viruses present in vaccine lymph,

lapine, smallpox minor, smallpox major, neuro-vaccinia of the rabbit, and generalized vaccinia of the same animal.

Craigie and Tulloch then made a detailed investigation on the technique to be followed in conducting the flocculation test, and arrived at the following conclusions :—

There is evidence that the test resembles a precipitation rather than an agglutination. Therefore, a technique in which the concentration of serum is kept constant while that of the antigen is varied gives more satisfactory readings than one in which the converse procedure is employed.

Whatever the nature of the antigen involved in the flocculation, it is almost certainly very finely particulate.

In extracting material to prepare antigens the best reagent is 0·9 per cent NaCl. The same electrolyte is eminently satisfactory for the process of flocculation. In the process of extraction a certain amount of protein must be brought into solution if a product suitable for conducting the test is to be obtained. If, however, too much protein is brought into solution the delicacy of the reaction may be interfered with, possibly because such protein may act as a protective colloid.

The reaction of the fluid in which tests are carried out is of great importance, for at approximately pH 6 and at pH 8 non-specific sedimentation is likely to occur. Buffer solutions prepared by mixing Na_2HPO_4 and NaH_2PO_4 should not be used either for extraction or flocculation, as these show an unexpected "acid drift" on incubation with vaccinia material in the presence of rabbit serum, normal or anti-vaccinia.

In the investigation of vaccinia-infected brain the possibility of ether-soluble substances present in the extracts had to be taken into consideration. Extracts of brain-vaccinia flocculate with anti-serum to dermal vaccinia, but the reaction is not readily demonstrated as the opacity of the antigen obscures flocculation. When the brain extract was treated with ether, then dried and triturated with 0·9 per cent NaCl, flocculation was clearly seen in the presence of the anti-serum. This finding has a practical application, as sometimes Craigie and Tulloch encountered difficulty in the investigation of smallpox crusts on account of their being greasy, either because they had been derived from skin rich in fatty secretion, or because ointment of some kind had been applied to the areas from which they had been obtained. Such greasy crusts were liable to give anomalous non-specific flocculation. Extracting these crusts with ether before trituration in 0·9 per cent salt solution eliminated non-specific flocculation, and the reaction was easily observed. The effect of simple ether extraction was very striking; the reading of results presented no difficulty even to inexperienced observers. Anomalous flocculation did not occur unless quite unnecessarily concentrated extracts—1 in 100—were used. Since introducing ether extraction anomalous flocculation has not been observed, provided the concentration of the extracts tested did not exceed 1 in 200. There is no need to use extracts of greater concentration than 1 in 200, provided the serum is used in its optimum concentration.

Full details of the preparation of crust extracts are given in the Report. The importance of selecting suitable crusts is stressed; epithelial scales and dried pus should be avoided. The minimum quantity of crust extract required is one cubic centimetre of 1 in 125 dilution, so that when diluted with serum the highest concentration of extract is 1 in 250. Therefore, 0·01 g. of dried selected material in 1·25 cubic centimetres of saline is sufficient, as it allows a loss of 0·25 cubic centimetre when the supernatant fluid is pipetted off after centrifugalization.

The crusts are dried and then extracted with ether. The ether-treated material is triturated with 0·9 per cent NaCl solution. The extracts are next frozen, then thawed and centrifugalized to remove the clot which forms and to obtain a clear product free from particulate matter. If necessary, the reaction is then controlled colorometrically with a standard solution of pH 7·2.

In performing the clinical test the centrifugalized extract is diluted from 1 in 125 up to 1 in 4,000 with saline, the volume of extract in each tube being 0·25 cubic centimetre. A control series is then diluted in the same manner. To one group of dilutions 0·25 cubic centimetre of anti-vaccinia serum is added, and to the control series 0·25 cubic centimetre of normal rabbit serum. The tubes are incubated at 45° to 55° C. for eighteen hours, when maximum flocculation is observed; but a strong positive reaction may be observed in two to three hours.

Anomalous flocculation has not been observed with the present technique, but should it occur through the use of unsuitable crusts or too strong serum, the floccule can be distinguished by its being usually in the form of a single veil-like structure, which is very loose and transparent, very fragile and easily dispersed.

The last three sections of the Report are of special interest. They deal with the action of anti-vaccinia serum upon vaccinia virus *in vitro,* the use of anti-vaccinia serum in giving passive immunity against infection, and the production of immunity with vaccinia sensitized by exposure to flocculating serum.

As regards the viricidal action of immune serum *in vitro*, there has been much difference of opinion. Andrews, as the result of his later work, thought there might be a stable antigen-antibody complex formed in a few days. This is in marked contrast to the fact that antibody appears to be effective *in vivo* in a few minutes. Craigie and Tulloch state that their experiments show that immune serum, such as is used for the flocculating test, exerts a specific antibody action on the virus *in vitro.* The serum appears to form a complex with the virus; the complex is rapidly formed and seems to be stable. After four hours incubation at 37° C. the formation of the complex is sufficiently complete to prevent demonstration of the virus by dermal inoculation.

The production of passive immunity by means of immune serum was examined by Andrews, who found that the injection of immune serum

intravenously had no effect on the development of local lesions. Thomson, by using a greater concentration of serum, found that animals could be protected to a certain extent.

Craigie and Tulloch have not gone into this question in very great detail, but their few experiments seem to justify the conclusion that a considerable degree of passive immunity is conferred on animals by giving anti-vaccinia serum such as has been used in the tests. Some immunity was conferred by the adminstration of flocculating serum in a dose of one cubic centimetre per kilo of body weight, but the protection was more marked when a dose of two cubic centimetres per kilo of body weight was given intravenously, even only one hour before the test inocula were applied.

The passive protection was not dependent on the serum being derived from the same animal species as that upon which the test was carried out. The serum protected against a very large multiple of the minimum infecting dose administered intradermally, by scarification or even by the intratesticular route.

The last section of the Report which deals with the attempts to produce immunity with vaccinia sensitized by exposure to flocculating serum is considered by the authors to be the most important part of their investigation and the logical outcome of the previous sections.

They state that "There is no unequivocal evidence that dead vaccine virus is possessed of any antigenic property." Immunity to vaccinia is believed by some observers to depend upon the persistence of *living* virus in the immune animal. They continue: "If it be true that an animal can overcome the invasive phase of infection with vaccinia, appear normal and be immune but still *harbour* the virus, it should be possible so to treat the living virus, *before* administration, that its invasive capacity is reduced sufficiently to prevent its producing marked lesions, but that, being still alive, it can stimulate the production of solid immunity."

Some of the previous experiments appeared to indicate that the precipitate obtained by flocculating vaccinia extracts with specific anti-serum contained living virus along with adsorbed serum.

The procedure adopted by Craigie and Tulloch was to flocculate an extract of rabbit crust with rabbit anti-serum and, having centrifugalized the mixture, to suspend the deposit in 0·9 per cent. NaCl, or, in some experiments, in flocculating serum. The mixture was then dried and rabbits were injected *subcutem* with the product. The product was also tested by scarifying a rabbit with various dilutions; it was found to be devoid of dermal activity, though the untreated virus was infective in a dilution of 1 in 50,000.

The rabbits injected *subcutem* with the deposit in saline or in serum were tested by scarification with dilutions of untreated virus. In the experiments with the deposit in saline some degree of immunity was observed. In the experiments with the deposit suspended in serum, one rabbit was found to have developed solid active immunity in eleven days;

the other rabbits tested after two days, five days, and nine days were not completely immune.

If the immunity depended on a living virus in the inoculum, it was thought that a small dose might suffice. This was found to be the case; a dose equal to $\frac{1}{1000}$th of the original extract was sufficient to stimulate the immunity mechanism.

Experiments were then made to determine whether the virus remained alive at the site of inoculation or in the internal organs of the animals which had received the sensitized material. Extracts were made from the site of inoculation and from the internal organs of animals which had been injected subcutaneously nine days previously with the sensitized product. Intradermal injections of the extracts showed that the site of inoculation and the brain were infective. This result appeared to indicate that although the sensitized virus remained alive, its invasive capacity was reduced.

Craigie and Tulloch conclude that their experiments demonstrate the production of immunity to vaccinia by the use of sensitized products devoid of skin infectivity.

They, however, issue a word of warning. They say it may be argued that, although by sensitizing infective material by serum we can abolish the capacity of a vaccine virus to produce a local skin lesion, the serum carried by the sensitized product may be powerless to control the virus should it disseminate. If this be so, then a sensitized virus may possess no advantage over unsensitized vaccine so far as the prevention of sequelæ, e.g., vaccinal encephalitis, is concerned.

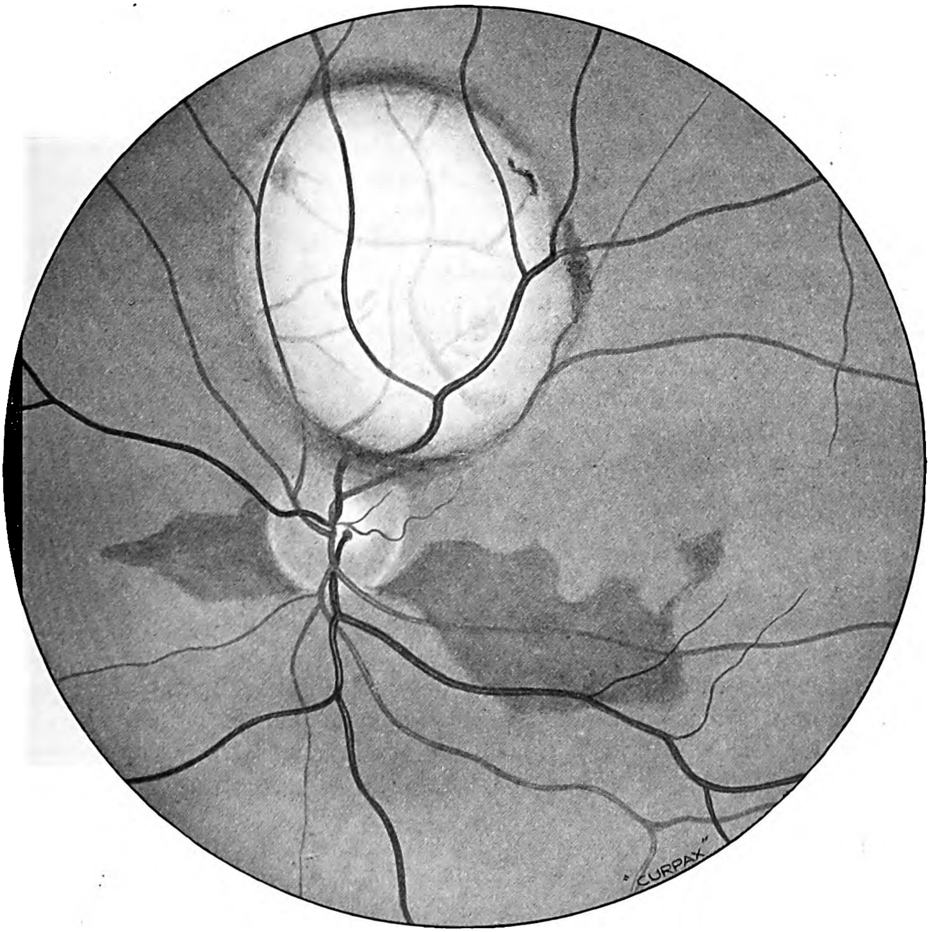
This last point, which is of paramount importance, is the subject of their present investigations; the results of this work will be awaited with keen interest.

Clinical and other Notes.

AN UNUSUAL CLINICAL TYPE OF SARCOMA OF THE CHOROID.

By Major R. M. DICKSON, O.B.E.,
Royal Army Medical Corps.

Subconductor O. R., aged 39, was admitted to Queen Alexandra Military Hospital, Millbank, on November 25, 1929, with a history of blurred left vision of two months' duration. Condition on admission:



Vision R. $\frac{6}{9}$, with $-0{\cdot}75$ cyl. axis $180 = \frac{6}{6}$. L. $\frac{6}{60}$ not improved. The left pupil was larger than the right, both reacted normally, and the tension in both eyes was normal. The picture in the left fundus was arresting. There was a cyst-like swelling above the disc, vertical oval in shape,

sharply defined, with a smooth white surface, and roughly six times the size of the disc. The swelling was focussed with a plus 8 lens; the sides were very steep, with marked looping of the retinal vessels which crossed its surface. No new vessels were seen. There were large wing-shaped hæmorrhages on each side of the disc. The remainder of the fundus was normal.

The site of the tumour made transillumination impossible. The blood Wassermann was negative, there was no leucocytosis, and the urine and cerebrospinal fluid were normal.

Dimness of vision was the only symptom, and was due to a scotoma in the visual field.

He was transferred to Moorfields Eye Hospital for a week, and was examined by the senior members of the staff.

They agreed that the eye should be excised at once, but there was difference of opinion regarding the diagnosis.

A glass globe enucleation was done on December 14, 1929, cutting the optic nerve as far back as possible. He was discharged on December 30, 1929, and six weeks later was provided with an artificial eye.

The tumour measured seven by five millimetres. In the microscopic sections melanin pigment was found only after careful search, but otherwise the structure of the tumour was typical of sarcoma of the choroid.

The prognosis in such an early case is good, and on August 14, 1931, twenty months after the operation, the socket was healthy, and there was no suggestion of metastic growth elsewhere.

The illustration is a composite one from microphotographs, and was done by Curry and Paxton.

RODENT ULCER OF THE NOSE.

By Lieutenant-Colonel H. H. LEESON,
Royal Army Medical Corps (*Retd.*).

Patient stated that she enjoyed good health all her life until four years ago, when an ulcer broke out on her nose. She was recommended by her local doctor to have radium treatment, which she did, four applications in all being given. She stated that this effected some improvement, but that the ulcer never healed up.

In May, 1931, as the ulcer was becoming worse, she was recommended to come and see me, which she did on the 29th of that month. She was then aged 89. I found a typical rodent ulcer on the left side of the nose, about ½ inch above the left nostril. I advised radium treatment again, and she attended hospital for that purpose, but was considered too frail and given a small dose of X-rays instead, the ulcer and surrounding skin being subsequently dressed with boric ointment.

On June 25, as the ulcer showed no sign of improvement, I tried

dressing the surface of it with lint soaked in a new preparation—anti-maligyn—keeping the lint moist with a small piece of oiled silk.

On her return four days later, a very marked improvement was noticed in the general appearance of the ulcer; the dressing was repeated. She attended again on July 7; the ulcer was then found to be completely healed, a small reddish discoloration being all that was left of the original ulcer; this has since disappeared.

Although it may be claimed that the X-ray dose previously given was largely responsible for the satisfactory termination of the case, yet I think, in view of the fact that such a rapid change for the better occurred as soon as the anti-maligyn was tried, that this substance had a very large share in the ultimate healing of the ulcer.

SOAK PITS.

By Major F. R. HUMPHREYS,
Late Royal Army Medical Corps (T.F.).

One of the troubles of camp life is dealing with greasy water, which soon renders the sides of the soak pit impermeable, and a fresh pit has to be dug.

The following method was found successful in a case where a large deep pit had thus become full of water which failed to soak away, though the soil was very porous.

A second very narrow pit was sunk about one foot from the large one. A communicating tunnel, lined with a tin canister, was established and opened into the large pit a little below the surface of the water collected in it.

The little pit promptly filled up; the grease, which had coagulated in the water, rose to the surface and only had to be skimmed off as it collected there in considerable bulk. The small pit remained full, all water being poured into the large pit, and the soakage from the small pit caused a constant current to it with the coagulated grease.

CARBON-MONOXIDE POISONING IN BARRACKS.

By Captain R. V. FRANKLIN,
Royal Army Medical Corps,

AND

Assistant Surgeon F. COURTNEY,
Indian Medical Department.

During the months of February and March, 1931, the following cases of carbon-monoxide poisoning occurred in a small hill station in the north of India. The climate being extremely severe, with half a foot of snow on the

ground, and a cold piercing wind permanently present, the men cheerfully "collected" coal, charcoal, and wood and, sitting huddled over Canadian stoves at night, cooked their suppers in their barrack rooms, there being no cafes, cinemas, or other sources of amusement. One day the sick parade, never large, consisted of four or five really sick men, who all complained of identical symptoms, headache, giddiness, and vomiting, but showed no definite physical signs and were a good healthy colour. Coming to the conclusion, from the history, that they were probably being poisoned by carbon-monoxide, the following Station Order was issued:—

S.S. Order 36. "The use of sigrees and the burning of charcoal in barrack rooms is strictly prohibited. Sigrees may be used in offices only with the special permission of the Station Commander." Cases then ceased.

About two months later I was suddenly called to the hospital in the early hours, and on arrival found the following two stretcher cases:—

Case A.—Soldier in a dazed condition, semiconscious, face pale, pupils contracted, breathing shallow and 34 to the minute, pulse 140, temperature subnormal, the whole body very cold, with spasmodic rigors, teeth clenched and patient very restless, tossing from side to side.

Treatment.—Oxygen was at once administered *per oram*, patient put to bed on the verandah and kept warm with hot water bottles and blankets, and a warm enema given with good results. He recovered full consciousness in about four hours, made an uneventful recovery and was discharged to duty seven days later.

Case B.—An old soldier completely unconscious, who had stopped breathing, was definitely pulseless, and cyanosis present to a marked degree. Mr. Courtney had been carrying out artificial respiration before my arrival, and this was kept up by turns for three-quarters of an hour. The patient had vomited before being brought to hospital; the pupils were widely dilated and a cold sweat covered the whole body.

Treatment.—Oxygen was at once adminstered *per oram* and saline transfusion apparatus made ready. Breathing, when re-established, was first of the Cheyne-Stokes type and very gradually became normal; the pulse, when perceptible, was 130 per minute, temperature in the rectum 101° F. A blood-slide was taken to exclude cerebral malaria and an enema was given, which was retained. That evening, as the patient became restless though still unconscious, a catheter was passed, and twenty-three ounces of urine were drawn off. The next morning, after twenty-four hours unconsciousness, the patient came to and was able to sip some hot coffee. He was very weak and complained of backache, probably due to congestion of the kidneys; he slept all day, and that evening, as he was still suffering from retention, a catheter was again passed and nineteen ounces of urine drawn off. Both specimens showed a specific gravity of 1040 but were otherwise normal. The patient gradually recovered strength and ten days later was discharged to outdoor treatment.

History of Onset.—On inquiry we found that these men were sleeping

in a small room, nine by sixteen feet, with all doors and windows shut. After the Orderly Corporal had been round at "Lights out," one of the men slipped out and brought in a home-made sigree composed of an old kerosine tin burning coal; this was placed between the two beds, and Case A, who was near the door, evidently got some air through the cracks, but Case B, who was against the wall, received the full concentrated gases, with the results described above.

We may mention that a third occupant, a dog, was also found unconscious, but, scorning medical aid, came to after being half an hour in the fresh air.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS.

Royal Army Medical Corps (Ret.).

(*Continued from p. 72, Vol. LVII.*)

I spent the summer of 1896 in Murree with Colonel Yaldwyn, and very pleasant and quiet days they were. My duties were confined to the charge of the 3rd Rifle Brigade stationed at Kuldana, and commanded by Colonel Montagu Curzon. Colonel and Mrs. Curzon were delightful persons with one very pretty little girl, who is now a Viscountess. Major Raikes was second in command and relieved Colonel Curzon. Raikes belonged to an old family in North Wales. Other officers were Major Metcalfe who died in the Waziristan campaign, 1897; Morris, son of Lord Kilmainham, killed in the Great War with the Irish Guards; Henniker, now Lord Henniker; Wynne of Pontefract, killed in a polo accident; Walsh, who lost an arm in the Boer War, Adjutant; Cavendish and Rickman, and some others I had known in Peshawar a year earlier. The Mess was situated on a neck of land with a steep declivity on each side, and in a setting of delightful scenery. It was a charming regiment to work with, and I soon got to know everyone well. Later I was very pleased when my younger daughter married an officer of the Regiment. My first experience of the Regiment was in 1882, when Major Aylmer Somerset introduced me to the Rifle Brigade at Winchester, and my last act was to relinquish medical charge of a Brigade of K.R.R.C. and Rifle Brigade at Sheppey at the end of the Great War.

I forget the exact reason, but I believe it was on Her late Majesty's birthday that Colonel Raikes and the Officers gave a dinner party, and invited the *èlite* of Murree to the Mess. The furniture of the dining-room had been increased by the addition of a number of camp chairs. It was a gay and festive scene, and the band under Mr. Richardson was playing exquisitely. I escorted Mrs. Lascelles, the wife of the Brigade Major into

dinner, and we took our places on two camp chairs. Something prompted me to see that my partner's chair was securely hooked up, and having assured myself that my lady was safe, we talked, when all of a sudden down I went with a crash, but luckily did not grab the table cloth in my fall. When I recovered everyone was laughing at my discomfiture, and I could hear Raikes saying from the position of President in a very warning voice, while he beamed with amusement, "Early, Morris, rather early."

Our fellows were very popular, and could be seen at every house and entertainment. The ladies of the station when they did not ride were carried in dandies by four men. One day Lieutenant S—— heard that a certain lady had been carried by her men from the cantonment and scared into paying them *baksheesh*, and it further transpired that this was getting unpleasantly common. A little strategy was exercised: it was arranged that one of these parties of jhampanies should take a lady from an officers' quarters. At the appointed time a lady stepped out, and when she was in the dandy the men asked for *bacsheesh*; she got up, and seized one of them, and began to punish him. He resisted the advances of the lady, who became enraged, and took on all of them and pitched them down the hill side. She then went to the Mess and dragged off her wig, disclosing S—— himself. This ended the bad behaviour of these men.

O'Keefe (now Sir Manus O'Keefe), was in medical charge of the Gordon Highlanders at Gharial, where Mrs. O'Keefe and he lived in comfortable quarters with their twin sons, whom we named Gharial and Topa, which were twin hills.

Nearly every Sunday evening I dined at The Terrace with Sir William and Lady Lockhart, who had been most kind to me since my wife died. I frequently met Sir Power Palmer, to whom I have referred earlier. He often rode in from Nuthia Gali, where he lived at the headquarters of the Abbotabad Brigade.

During the winter I tried to make a tent that would be lighter, and actually as efficacious as the E.I.P. My old friend Tomkins placed the resources of the Tortoise Company at my disposal, and Brooke Greville paid me a long visit. He lived at our Mess, and by his pleasant ways became very popular. I enlisted the assistance of the great Boota Singh, tent-maker. It was arranged that I should plan out a tent, and that Boota Singh would send a cutter to cut the tent according to my plan. Everything was ready, and I was awaiting the arrival of the cutter of tents. The place where this was to be done was by the hospital at Campbellpore, and on the outskirts of the camp. One morning a small party of horse and foot was reported, so I went out. In front, mounted on a pony, and clothed in a skin tied round the waist with a camel-hair cord, wearing a small pugri and voluminous trousers, and shoes, was a handsome though small Pathan of the Shinwari tribe which inhabits part of the east side of the Khyber Pass. A man followed carrying a huge pair of scissors in a case on his back, then some more attendants and baggage. Dismounting, he

salaamed and I invited him to eat and rest, and at the "*Sham ki waqt*" I said I would visit him and he could cut the tent. The same evening I had my tent erected in skeleton, that is to say, the seams were represented by cords on the poles. The tent-maker looked at it and asked me one or two questions and then spread the canvas on the ground, and taking up a certain position he looked intently at the skeleton and then at the cloth and measured it by spanning his hand. His scissors were then handed to him, when after one more searching look he cut deliberately half the tent. His assistant easily duplicated this and the tent was ready to be sewn. This old man cut about four lines several feet in length, and without a fault. He then smiled and asked leave to go, and rode away in the evening to the Attock bazaar about ten miles away. I asked about this old man, and was told that he had cut most of the original tent patterns in the Punjab, and that his art had been handed down from father to son for many generations.

The hot weather of 1897 I spent at Campbellpore, a nice, quiet little station. I married, one year and two months after my first wife died, a friend, the daughter of an old Bombay Civil Servant. In May the heat was considerable and there was an outbreak of enteric fever among the troops. I took infinite pains to trace the cause but could get little encouragement. One of my seniors gave me some advice, and it was "not to put down hares and chase them." I was chasing enteric fever with all the effort I could make, and I wrote report on report. Scientific matter I usually published in our Journal, the Editor of which was very generous to me. Well, I pursued the hare of the enteric outbreak at Campbellpore day in and day out and I did effect something. It happened in this way. One afternoon I passed an auction going on in the barrack square, and enquired what the sale was. "The effects of deceased soldiers, sir," was the answer, and I discovered that the sale actually included the clothing returned to store of a man who had died of enteric fever, after it had been disinfected. I was always a sceptic of the old-fashioned disinfection, from the days at Allahabad when I was ordered to burn four ounces of sulphur in a street in the Regimental Bazaar to ward off cholera and astonished my chief by indenting for fourteen pounds of sulphur for one barrack room.

I followed this discovery up and wrote a long report on it, which Sir Robert Harvey took up keenly, and referred to it in the next report of the Sanitary Commissioner with the Government of India.

Enteric fever was at nearly the highest mark of intensity and the mortality in these years was very great. I always felt our impotence to deal with it and shared the keen anxiety we all felt to lessen its effect upon the strength. The humble note from Campbellpore in 1897 started the more careful disposal of clothing and the disinfection of stores. From that period all enteric clothing, bedding, and equipment was marked with an "E" and kept separate. Disinfection was still carried out under the old rules, but I remained sceptical of its efficacy, and indeed I doubted if an effective disinfection could be obtained except by heat or boiling.

About this time things were getting rather unsettled on the Frontier, and the Afridis were giving much trouble. The torch had been lit, and a little later the Frontier was in a blaze of insurrection.

Fanatical mullahs were preaching a *jihad* or holy war. A British force under General Yeatman-Biggs had proceeded to the Kurrum Kohat district in July, when the heat was intense, and the climate most trying for British soldiers. The troops were railed to Kushalgarh, and then had two long marches over a stony wilderness to Kohat.

The elusive Orakzai Afridis were giving a great deal of trouble, especially round the forts of Gulistan and Saragarhi. I forget the exact date, but it was about August, 1897, that Gulistan was relieved with difficulty, and the seige of Saragarhi had started. The devoted garrison was commanded by Captain (afterwards Major-General) Des Vaux. The relief of Saragarhi was a very urgent matter, and the G.O.C. marched a force, including the Royal Irish, to Hangu, and up a hill to Fort Lockhart, and then called on them to march on to Saragarhi. The Royal Irish could not march that day beyond Fort Lockhart. In consequence they fell under the displeasure of the authorities and were ordered to the base, and I recollect the sullen march they made through Kohat, with no salutes. I felt for those gallant men, for I think they had done all that could be expected from them, marching in the most trying heat, uphill, and covering about thirty miles, or two forced marches. I never heard exactly how they reached Fort Lockhart, but fifty per cent must have fallen out and then struggled in. The incident caused much stir, and it was not till the Colonel of the regiment, General Sir Havelock Allan, V.C., nephew of the great Havelock of the Mutiny, came out, that the matter was explained and the regiment went again to the front with the column acting from Peshawar, and later passed up the Khyber. A few weeks later Sir Havelock Allan, ignoring guards, was returning from Landi Kotal, when he was shot by a man from a cave on the side of the hill, and fell mortally wounded. I rode out from Jamrud, and met the party bringing the body in. This was transferred to Pindi, where he now lies under a beautiful tomb. I never spoke to Sir Havelock Allan, but everyone liked him and deplored his loss

In September the Government decided to punish the rebels on the Frontier, which by this time was alight with insurrection from Quetta to Peshawar. A large army was ordered to mobilize, and to "Rendezvous on an advanced base at Kohat."

To my surprise and satisfaction I woke one morning to find that Surgeon General A. A. Gore, P.M.O. of India, had selected me as Staff Officer to the Principal Medical Officer, Tirah Expeditionary Force. I had never dreamed of such preferment, and I hoped I would carry out the duty successfully.

I did not know who was to be P.M.O., but every sign pointed to Surgeon General Sir Robert Harvey, so I went through to Murree at once to see

him. When we met I saw that there was something wrong; he told me he was not sure what he would do, but would certainly see me later. The evening was very wet and cold and we stayed at the Lancaster Hotel. It must have been about 9 p.m. when Whitehead turned up wet to the skin. He had come from some hill station near Murree and asked me to do my best to get him up to the front; I promised him I would if an opportunity occurred, and later I prevailed on my Surgeon General to ask specially for him. I often wondered in later years if Sir R. H. Whitehead, K.C.B., remembered this. He also told me that Colonel Thomson with the Chitral force, would become P.M.O. for the present. I was sorry for Sir Robert, because he would have been an excellent P.M.O.

I met Colonel Thomson at Kushalgarh and we passed through to Kohat. We formed an office in the General Hospital, and commenced to get our organization going. I remember Sir Ian Hamilton turning up from Olympus, but his horse threw him the day he marched out of Kohat, and he broke his arm and had to return to India.

It was very hot and oppressive at Kohat till the evening, when a breeze blew over the station and refreshed us. It came in the direction of Hangu, and was known as the Hangu breeze. These mountain passes are known for their breezes, which blow in the evening and are caused by conditions of radiation. Except on one side we were surrounded by the Jowaki Hills, the Kohat Pass, and the ridge running to Hangu, while below ran the river Kohat Toi. On one of these hot afternoons Sir William Lockhart arrived to take over supreme command with General Nicholson as Adjutant-General. After a day or so, the force marched to Usterzai and Hangu; here we entered a long wide stony valley flanked on the east by the Samana and far away by the Kurram Hills and Shutar-gurdan (camel's neck). Later we advanced to Shenauri, while part of the force proceeded to Thul and the Kuman. The Surgeon General, which rank Colonel Thomson now possessed, liked me to ride far back on the line of march and assure myself that no medical units were in any difficulties. Our last march was well in the enemy's country, and a rearguard action was possible at any time. Riding back I discovered the advanced medical depot had broken down, the ponies being unable to carry it any further. Worst of all the subordinate officer in charge, an old man, was done up and was weeping. The rear guard had not yet come up and we were in rather an exposed position, but the broad daylight reduced risk of attack. I was in a quandary when Lieutenant MacMunn suddenly appeared with some Jeypore transport returning from the front. I pointed out our plight, he gave me transport and solved our difficulties. He is to-day Lieutenant-General Sir George MacMunn, K.C.B.

The transport ponies were not equal to the weight of the medical panniers, and should never have been supplied. The same evening I reached Kai, a well-known Afridi village, and later saw some firing by the troops near Fort Gulistan. I rejoined the Surgeon General the next day.

Shenauri was a nice camp just below the Dargai heights which were soon to be the scene of considerable action. The battle of Dargai occurred two days later and I saw it from a spur below the Saran Suk, where Sir William Lockhart stood with some of his staff. There were many casualties, and I recollect visiting Major McBain of the Gordons, who was reported in camp as seriously wounded. McBain had a round bullet resting on the sheath of the femoral artery, but luckily not severing or injuring it. He arrived at the hospital with a tourniquet applied and an officer watching him. At the examination the bullet rolled out, not having done any damage of consequence.

We followed the troops on the next day over the pass and began a zig-zag journey down hill towards Karuppa. It was no route for ordered marching ; only independent progress, taking care not to fall over the steep khud, was possible. It was alarming, for the marching on the higher turns of the road loosened stones and dust, and occasionally a transport animal would go over and cause no end of trouble as it passed the zig-zags below to the bottom of the hill, 100 feet or more. I saw one camel fall, but at some distance from me. It became very hot on this march as the sun was reflected off the stones and rocks. We were tired, and what was worse, could not find any good water. When night fell we bivouacked under some rocks and passed a very uncomfortable time, though we slept well after a long and fatiguing march. Early the next morning we resumed our advance and by the early afternoon arrived at Karuppa. This was a small unimportant village in the land of the Orakzai Afridis, and our camp was on a raised portion of ground, on one side of which ran the Khandi-Mishti stream, arising in a hill range near the town of the same name under the Sarungha Heights, lately notorious for the recovery of Miss Ellis by Mrs. Starr. The camp was surrounded by high hills, of which those in front were within easy range. The water here was full of lime and sediment, which was removed by means of alum. After a bath and two hours sleep I felt better, and the Surgeon General and I having enjoyed our tea strolled about the camp. A night attack was fully expected and arrangements were carefully made to meet it. I was much struck by the bleak, stony, wild sort of country, with rugged peaks and unfriendly looking places. As we returned we met Colonel Matthias who had led the Gordons at Dargai, and he and the Surgeon General fell into conversation while I waited. Just at this moment a bullet whizzed past us and I made a splendid " duck," at which Matthias and the Surgeon General laughed. I was very annoyed with myself. But when another came a bit nearer which caused Matthias to nearly fall on to the ground, and the Surgeon General gyrated, I did not move a muscle. As soon as it was dark the enemy began to snipe us and casualties were occurring, among whom was Badcock of the Headquarters' Staff shot through the arm. Morgan, the Staff Surgeon was invisible, so I took the case over and got Badcock down to Whitehead, who in the morning amputated the arm with his usual skill.

In our camp at Karuppa the night was lively. We were fired into from three sides and also expected an attack by the cliff on the remaining side. Our camp was on a triangular tongue of land sloping in a northerly direction to a cliff, below which ran an arm of a river, while the east and south sides were more or less divided from a steep hill rising perpendicularly and covered by trees, from which we were being sniped. It was very unpleasant, but about nine o'clock some volley firing stopped it. In the meantime an attack was developing before the cliff and the enemy were "*sangering*" up to us. The Gordons and the Dorsets lined the cliff. The night was very dark, but we could hear the foe working, and at the same time they were sniping the camp. The G.O.C. ordered star shell to be fired, and then the Afridis could be distinctly seen close up to our position. At once the rifles rang out and almost annihilated the invaders. One man was killed within six feet of the cliff. After this things became quiet and the few casualties were treated. In the morning there was abundant evidence of the seriousness of the attack. It was very noticeable how the enemy carried off their wounded on their shoulders; they also took away their dead. I only saw one dead Afridi as we were advancing at the action of the Sampagha Pass, which lies to the right of the Khandi-Mishti. He had been shot through the heart as he was running down the hill, and was in a state of rigor, still maintaining the running position and balanced by an outstretched hand against the hill.

The next day we advanced on to the plain below Khandi-Mishti and made for the Sampagha Pass.

The Surgeon General rode round the hospitals. No. 24 was in charge of Lieutenant-Colonel J. Bourke (now Sir J. Bourke). He was a fine administrator, and I often served with him. O'Keefe was one of his M.O.'s and Austin another. Gerrard was with the Gordons, and distinguished not only professionally, but also for dash and personal bravery. Burtchaell, with the Dorsets, was another of the same sort. Both passed over my head afterwards, and I never begrudged their doing so, for they fully deserved it. Colonel E. Townsend was P.M.O. of the 1st Division. He was essentially an active service man. He delighted in it, and gave invaluable service and sound practical advice. He hated paper and returns. Sir Penn Symons commanded this division. He was killed later at Elandsfontein. Colonel Davis, I.M.S., was P.M.O., 2nd Division, a charming personality and a good administrator. Colonel Thomsett held charge of the Peshawar Column.

We rapidly attacked the Sampagha and could see much movement about the village of Khandi-Mishti. On the crest of the hill above it was a laskhar of the enemy waving black flags and making for the pass. We rushed it, and I was the fifth officer over the top, but could not save De Butts, of the R.A., who was shot through the femoral artery twenty yards from me. After a short rest, I marched into the Mastura Valley with a nice-looking native who spoke good English. We examined a native

house and looted some swedes, and then I found out that my friend was the Maharajah of Dholpur. Two days later we fought the action of the Arhanga Pass and entered Tirah.

We were now in the heart of the Tirah, at a camp called Maidan. This was a long, lozenge-shaped place divided by a large rock, and surrounded by high mountains. The western part of this valley was called Bagh, and the end of it was close to the Kurram and the Shutar-Gardan (camel's neck), and the route to Cabul. Parachinar is an advanced post here, and as I write I remember a story of Lord Kitchener some years after. A certain Captain at this lonely place had left his wife in India, as ladies were not allowed here. However, this lady wrote to the C. in C., and asked him to let her join her husband. The Chief wrote a charming letter in reply, in which he pointed out that there were only two officers who could hold that important post, her husband and himself, and that at present he could not be spared. I know no more, but I expect something pleasant was done when the opportunity occurred.

We remained a month, or more, in this valley and, though it was tedious, we had some lively interludes. One evening, the Surgeon General, Colonel Balfe, Padre Dyer and I were having our dinner, when a bullet passed through the tent just above our heads. The effect was magical, for we fell off our bales of hay on to our backs, and I remember seeing a leg trying to put out our light. It transpired that some snipers had crawled up and had a shot. Captain Bruce (now Brigadier-General Bruce, of Mount Everest fame) took out his Ghoorkas and caught some of them.

Colonel Balfe was the Judge Advocate-General, and lived at our Mess. He was a great acquisition to us, and we were fond of him and his dry wit. He always placed a hanging rope outside his tent, as a warning generally of his office, and to mark his residence. Chaplain Dyer, too, was a host in himself. He had written some books and was a cultured Oxonian. I have heard nothing of him for many years. Life became very stale at Maidan, the Surgeon General was never well, and got very yellow sometimes. This made him anxious and irritable, but otherwise he was very pleasant. We then moved to Bagh, at the west end of the valley. Colonel Warburton and Sir Richard Udny held several meetings and tried to induce the tribes to yield, for it was not at all pleasant shooting these fine men. At one jirgah the evidence of the effects of a blood-feud became very evident. The chief men of the tribes were sitting armed in a circle. Suddenly one of them saw his enemy, levelled his rifle, and shot him. He then walked away. No notice was taken of the incident, for we were not in British territory, and these events were common. It is a land where the *vendetta* is understood and strictly followed. Every house or homestead usually has a tower from which an enemy is watched and waited for, and there is hardly a family which is free of this unpleasant feature in their social life. The Afridis and Pathans are a singularly brave race, with a strict code of honour, and especially as regards the carrying out of a promise. Again, hospitality is a pronounced mark of this race. They give it generously, and they accept it.

Nothing would induce them to dishonour it. The Pathan is full of faults, but he is a man. He has a deep respect and love for an Englishman, and an intense regard for the power of the British Raj. This is well illustrated in a frontier proverb, which runs :—

> "The patience of the Sircar is as long as a summer's day;
> The arm of the Sircar is as long as a winter's night."

The Pathans are a cheery race, and very happy. They march with a fling and independent air, singing and playing on reed pipes, making a shocking noise and discord to Western ears. I once met the Khyber Levy marching with its reed band playing, and shall never forget the effect it had on me. The nick-name of this Corps is the "Catch 'em alive, Oh's."

The final stage of the war was the march down the Dwtoi Defile. This was a narrow dangerous passage between high rocks which were commanded at every turn. This is how it was managed. The night before Colonel Warburton (afterwards Sir Robert Warburton, Warden of the Marches) sent for certain influential chiefs, about six of them, and persuaded them to promise to picket the defile for the army to pass through the next day. They promised, and the compact was sealed by a present of some goats. They marked the points strictly where their picketing began and where it ended. They kept their promise and the British Army passed with the enemy sitting with their rifles in their hands above them. The pass was traversed in safety, but directly they emerged into the open and beyond the mark a furious action ensued fought for some hours with many casualties. With the darkness the fighting ceased and the army eventually emerged on to the plain at Jamrud at the entrance to the Khyber.

The work had been hard and difficult, and as we slackened I began to feel the strain, besides which my teeth were loosening, so I was boarded and given six months' leave, but was asked to go up to Simla first and help to get the report on the war finished. I was very glad to go to Simla.

We demobilized on April 9, 1898, and I left immediately for the Hills. I shall never forget the sense of relief and freedom on getting away or the exhilaration and exaltation of spirits when I first saw the Hill of Jacko and wonderful Simla for the first time.

Sir George White had retired and Sir Charles Nairn had succeeded. He lived at Snowdon, just below Jacko.

Surgeon General A. A. Gore was P.M.O. India. He was a highly cultured man and he had written much on current military matters as well as on medical history. We spent many pleasant times at his house with Mrs. Gore and Miss Gore. They were delightful hostesses and we always enjoyed their garden parties and dinners. Surgeon General Thomson's health much improved at Simla. He died later of carcinoma of the liver.

We finished our reports. Whitehead, Gerrard and Burtchaell were promoted, the two latter for conspicuous bravery.

I then determined to venture up to the Thibetan Frontier.

(To be continued.)

Current Literature.

HANNS, A. La fièvre typhoide pendant la guerre de 1914 à 1918. [Enteric Fever during the Great War.] *Rev. d'Hyg. et de Méd. Préventive.* 1930, v. 52, 817-39. [36 refs.]

The whole number of recorded cases of enteric fever in the French Army on the Western Front during the Great War was 124,991; the number of deaths was 15,211. There were three epidemic periods. The first, which extended from November, 1914, to June, 1915, was much the most serious and produced more than 60,000 cases; this was mainly due to *Bact. typhosum* infection. The second, which culminated in September, 1915 (there were over 6,000 cases in that month), showed an increasing proportion of infections with *paratyphosum* especially *Bact. paratyphosum* A. The third and least important outbreak, with a maximum in September, 1916 (1,254 cases) was again a *typhosum* infection. In the first epidemic, the fatality was of the order of 17 to 18 per cent., in the second and third much less. During the period when paratyphoid infection was dominant, the fatality was of the order of 3 to 4 per cent.

The first epidemic seems to have spread from the Argonne front and to have been disseminated by personal contamination of foodstuffs. At the outbreak of war relatively few of the troops were vaccinated and it was only from February, 1915, that vaccination (against *Bact. typhosum* only) was seriously carried out. The author attributes the decline of the first epidemic to this and the subsequent appearance of paratyphoid infections to the use of a simple vaccine. A triple vaccine was used first in December, 1915, but it was not until some months after that the proportion of men exposed to risk who had received the triple vaccine became large. The increase of true typhoid infections in the autumn of 1916 is attributed to the wearing out of the protection conferred by the original vaccinations. The author discusses diagnosis and complications and provides various tabulations. The most interesting is a comparison of 766 cases of typhoid, 4,412 cases of paratyphoid A and 810 cases of paratyphoid B. The fatalities were 17·6, 2·01 and 1·0. Perforation occurred in 3 per cent. of the cases of typhoid, in 0·06 of the cases of paratyphoid A and in 0·5 of the cases of paratyphoid B. In 4·3 per cent. of the cases of typhoid the type was hypertoxic, in only 0·3 and 0·6 per cent of the cases of paratyphoid A and B respectively was this type observed. It is not, however, possible to establish a diagnosis from purely clinical indications.

The author considers that the whole experience establishes conclusively the value of anti-typhoid inoculation—"as exactly as a series of laboratory experiments."

M. GREENWOOD.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 5.

HADLEY, P., DELVES, EDNA, & KLIMEK, J. **The Filterable Forms of Bacteria: I. A Filterable Stage in the Life History of the Shiga Dysentery Bacillus.** *J. Infect. Dis.* 1931, v. 48, 1—153. [6 pages of refs.]

The authors describe the occurrence in plate cultures of *Bact. dysenteriæ* (Shiga), of minute colonies measuring 0·004 to 0·2 mm. in diameter. The organisms which produce colonies of this type are referred to as the "G" form of the bacillus. The appearance of the G form is largely determined by the conditions of cultivation; it tends to appear whenever a strain is undergoing dissociation—as in the S —> R variation—and the addition to a medium of substances which tend to induce dissociation, such as lithium chloride or pancreatin, encourages the appearance of G colonies. Morphologically the G form consists mainly of minute cocci or coccobacilli. Films from agar may show in addition peculiar sheath-like structures, mycelial threads, and a viscous substance in which the minute coccal forms appear to be embedded. The G form may be propagated by subculture in broth, but the type and amount of growth varies widely, as do the results obtained by further subculture from broth to agar. Propagation by subculture from agar to agar frequently fails, particularly with newly-formed G variants. When broth cultures of the G form are filtered through Berkefeld N and W candles, growth occurs in the great majority of cases, either in the filtrates themselves, or in tubes of broth inoculated with the filtrates. Growth after filtration is always slow, and weeks or months may elapse before a visible turbidity or deposit is produced. If the filtrate is subcultured directly to an agar plate, no detectable growth usually occurs; but if, following the technique introduced by Hauduroy, the surface of such a plate, after incubation, is washed with a little sterile broth, a second plate sown with these washings, and the process repeated in series, a growth of G colonies is usually obtained after a few serial subcultures.

The G form appears to be non-pathogenic for rabbits; it differs biochemically from the parent form in fermenting maltose; and it is antigenically distinct from both the S and the R forms. It is resistant to a bacteriophage strain to which the parent form is susceptible. It possesses, indeed, few, if any, of the typical characters of Shiga's bacillus. It can, however, be induced to revert to the original type, although a prolonged series of subcultures may be required. It is noted that the G cultures, or the elements derived from them by filtration, remain viable over long periods of time, even under relatively unfavourable conditions.

The paper ends with a full and detailed discussion of the significance of these observations. The conclusion is reached that the G cultures and the associated filtrable forms represent definite cyclostages in the ontogeny of the Shiga bacillus, and that they constitute, in part at least, the gonidia and microgonidia.

Although Shiga's bacillus alone is considered in detail in the present

report, it is noted that the authors, or their colleagues, have been able to obtain similar G forms from several other species.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 5.

FELIX, A., and RHODES, M. **Serological Varieties of Typhus Fever.** *J. of Hygiene.* 1931, 31, 225.

FELIX, A. **Specific and Non-specific Reactions in Typhus Fever.** *J. of Hygiene.* 1931, 31, 382.

WOLFF, J. W. **Observations on the Weil-Felix Reactions in Tsutsugamushi Disease.** *J. of Hygiene.* 1931, 31, 352.

During recent years a fresh interest in the significance of the agglutination reaction with *Bacillus proteus* X 19 has been aroused by the occurrence of typhus or typhus-like fevers in parts of the world where their existence had hitherto not been appreciated. Examples of such fevers are Brill's disease in the United States of America; endemic typhus of Australia; tropical typhus of the Federated Malay States; and the *fièvre exanthématique* of Marseilles.

In the Federated Malay States Fletcher and his co-workers have established the fact that the cases of typhus which occur there may be divided into two groups which differ in their serum reactions. In the first group, known as "shop typhus," the blood-serum of patients reacts with the usual *B. proteus* X 19 strains; while in the second group, designated "scrub-typhus," the serum fails to react with type X 19, but reacts specifically with a particular strain of X 19 known as the "Kingsbury" strain or X K.

Two serological types of *B. proteus* X strains have been recognized for some time. These strains, known as X 19 and X 2, while they possess an H or flagellar antigen in common, yet differ in their O somatic antigen to such an extent that they must be regarded as different seriological types. These types are as distinct as are the known types of Salmonella, or dysentery bacilli. It is important to remember that in regard to the Weil-Felix reaction it is only the O antigen and its corresponding agglutinin which has any diagnostic significance.

In the case of the Kingsbury strain it has been found that, while its H antigen is in part identical with that common to all X strains, yet its O antigen is completely different from that of X 2 or X 19. The interesting fact emerges that the Kingsbury strain is a direct descendant in laboratory culture from an authentic strain of X 19.

In the course of the first paper the writers give the results of testing a number of serums from typhus-like cases occurring in different parts of the world against the known serological types of *B. proteus*. In many cases the degree of agglutination seen has not yet reached a diagnostic level, but is regarded by the authors as demonstrating a relationship

between the virus and the X strain concerned. The theory is put forward that the specific infecting agents in these fevers are more directly related antigenically to serological types of *B. proteus* which have not yet been isolated. Thus, in cases of tsutsugamushi disease from the East Indies and Japan there was found to be appreciable agglutination of the Kingsbury strain, while X 19 and X 2 were unaffected. Again, in cases of Rocky Mountain spotted fever from the U.S.A. some degree of agglutination was seen with X 19 and X 2. Similar observations have been made in patients suffering from the *fièvre exanthématique* of Marseilles.

The authors believe that these diseases represent different seriological varieties of typhus fever. They conclude that the significance attached to negative agglutination tests with some typhus-like diseases requires revision in the light of recent observations.

In the second paper Dr. Felix discusses the question of the specificity or otherwise of the Weil-Felix reaction. It is known that the serum of some typhus patients, in common with the serum of cases of syphilis, leprosy and other severe diseases, will agglutinate a number of organisms in higher dilution than with normal serum. Among these organisms is the *B. agglutinabilis* U 2, which has been suggested as equally suitable for the Weil-Felix reaction as the X strains of *B. proteus*.

In the author's hands the *B. agglutinabilis* U 2 has been found to be non-motile and hence its agglutination is of the O type. No community of antigen has been discovered between U 2 and X 19.

Tests carried out with normal human, rabbit, chicken and guinea-pig serums, showed that in many cases there was marked agglutination with U 2, while agglutinins for X 19, if present, were in very low titre. Tests with serum from patients suffering from syphilis and leprosy showed an increased agglutinating power for U 2 compared with normal serum, while that for X 19 was no more intense than in the case of normal serums. On the other hand, in the case of serums from typhus patients there was increased agglutinability not only for U 2 but also for X 19. It is clear, therefore, that as regards *B. proteus* X the reaction with typhus serum is peculiar to typhus infection. As regards the *B. agglutinabilis* U 2 the reaction is in no way specific for typhus fever, since similar reactions occur in cases of syphilis and leprosy.

Some community of antigen was established between the *B. agglutinabilis* U 2 and certain strains of *B. coli* which would account for the agglutination of the former by normal serums. Further experiment proved that the increased agglutinating properties, which are found in the serums of cases of typhus fever, syphilis and leprosy for "poly-agglutinable" organisms of which U 2 is a type, are explained by physico-chemical changes in the serum proteins which are known to occur in those diseases.

In the opinion of the author, therefore, the reaction with the X strains of *B. proteus* constitutes a specific test of typhus infection. Contrary results of other workers have been due to a failure to employ adequate

controls, such as the use of inactivated Wassermann serums in which the O agglutinin has been partially destroyed. The importance is emphasized also, when employing these serums, of a knowledge as to whether they give a positive or negative Wassermann reaction.

In the last paper of this series the author notes that both "scrub" and "shop" typhus occur in Sumatra. In addition, a third typhus-like disease, known as tsutsugamushi, is found which is characterized by the presence of a primary ulcer and bubo, and in which the vector is known to be a mite.

Blood-serum of patients suffering from tsutsugamushi fails to react with *B. proteus* X 19, but it has been found that in thirty out of forty-five cases positive agglutination occurred with the Kingsbury strain of *B. proteus*. Titres as high as 1/1000 have been noted.

In view of the fact that the serum from cases of "scrub" typhus also reacts specifically with the Kingsbury strain the serological differentiation of the two diseases is not possible.

The author concludes that it must remain an open question whether "scrub typhus" and tsutsugamushi are caused by the same virus or not and whether the two diseases should be separated according to the presence or absence of a primary ulcer and bubo.

STUART, G., and KRIKORIAN, K. S. **Anti-Rabies Immunization.** *Trans. Roy. Soc. Trop. Med. and Hyg.* 1931, 25, 49.

STUART, G., and KRIKORIAN, K. S. **Appearance and Persistence in Rabbit's Blood of Rabicidal Antibodies produced by various methods of Anti-Rabies Immunization.** *J. of Hygiene.* 1931, 31, 414.

The first article by these authors deals with a consideration of a series of cases of individuals bitten by two rabid wolves in whom the treatment with carbolized fixed virus was successful.

As one of the individuals was bitten by two rabid wolves within a period of three weeks, the question naturally arose as to the length of time that the immunity, which develops as the result of treatment, will persist.

Although there is no absolute proof that rabicidal substance, which develops in the blood after treatment, is actually an index of treatment, it was found by serum-neutralization experiments that this substance did not appear in the blood of individuals under treatment until a period of twenty-three days had elapsed. The rabicidal activity appeared to reach its maximum about fifty days after the completion of treatment. After this the titre began to fall fairly rapidly.

It would appear that although anti-rabies immunity may be fully developed, comparatively little rabicidal material is produced by the administration of ordinary doses of carbolized-fixed virus.

The second article deals with experiments with rabbits to determine the relative values of fresh carbolized and etherized fixed virus in stimulating the production of rabicidal antibodies. The results obtained in the

experiments recorded indicate clearly that rabbits treated with killed etherized-fixed virus develop rabicidal antibodies earlier and in greater amount than rabbits treated with equal weights of fresh-fixed virus or killed carbolized-fixed virus. At the same time the antibodies in the case of the etherized virus persist for longer periods.

MACHATTIE, C., MILLS, E. A., and CHADWICK, C. R. **Naturally Occurring Oriental Sore of the Domestic Cat in Iraq.** *Trans. Roy. Soc. of Trop. Med. and Hyg.* 1931, 25, 103.

Although *Leishmania tropica* has been experimentally inoculated in the skin of cats, monkeys, rats, mice and guinea-pigs, the authors have been unable to find any record of the disease occurring naturally other than in man and the dog, except the report of MacHattie and Chadwick in 1926 of Oriental sore on the mouth and nose of a Khurdestan bear.

Two cats were sent to Baghdad from Baquba, a village about thirty miles distant, where there is much human and canine Oriental sore. One of the cats had a typical Oriental sore on the nose, one on the lower left eyelid, two young papules inside the left ear and a mature papule on the margin of the left ear ; the other animal had a large sore on the nose. *L. tropica* was found in smears made from the sores, and on culture flagellates were grown which were indistinguishable from those cultivated from Baghdad boils of man and dog. Smears and sections of the spleen, liver and bone-marrow showed no parasites.

The authors were unable to infect four white mice by inoculating them with condensation fluid of cultures from the first described cat, while they were able to infect white mice with cultures made from Baghdad boils on the ears of two dogs.

Failure to infect white mice with a culture from a cat leads the writers to consider that passage through the cat may diminish the virulence of *L. tropica.*

There is a plate with excellent photographs of the lesions in the two cats, as well as a microphotograph of a smear from a lesion and of a culture.

Reviews.

OFFICIAL HISTORY OF THE GREAT WAR. MEDICAL SERVICES. CASUALTIES AND MEDICAL STATISTICS. By Major T. J. Mitchell, D.S.O., M.D., R.A.M.C., and Miss G. M. Smith, M.B.E., M.A. London: H.M. Stationery Office. 1931. Pp. xx + 382. Price £1 1s. (postage extra).

At the present time, when members of the medical profession seem to get so much adverse criticism, it is with feelings of pride that we can show to our critics this the last volume of the official Medical History of the Great War.

Here, in a comparatively small volume, Major (now Lieutenant-Colonel) T. J. Mitchell, R.A.M.C., and Miss G. M. Smith have accomplished a stupendous task and have produced order out of the chaotic mass of material with which they were faced in September, 1925. Here one gets a real picture of the mighty effort that the British medical profession and nursing services made in the Great War.

Out of eleven million casualties, eighty-two per cent of the wounded and no less than ninety-three per cent of the sick and injured were sufficiently restored to health to go back to some sort of duty.

The Introduction to the volume gives us the story of how, at last, after many vicissitudes this book, with its 354 separate tables, came to be written.

The opening chapters give a concise and comprehensive survey of the total casualties suffered by the various expeditionary forces; the succeeding chapters deal with individual campaigns and have been specially prepared to draw attention to the important statistical features of the campaign under review.

The authors have kept in view the type of information which was regularly called for or constantly used during the war by staff, administrative and medical officers, and it is just this information, so clearly given, that makes the book so useful now and so valuable in any future national emergency.

As the authors state, the medical statistics of the Great War would be incomplete without some reference to the numbers discharged from the Service as invalids and the numbers who ultimately received compensation from the State for disabilities incurred owing to service, and so the concluding chapter of the volume, for which Dr. Alexander Sandison is responsible, gives a concise account of the work done by the Ministry of Pensions since its inception.

The book is a mine of information, and it is quite impossible in a short review to give more than a very general idea of its contents.

A table which will be of special interest to the Corps appears on p. 43.

It gives in percentages the battle casualties suffered by the various arms of the Service in five of the more important battles on the Western front. In this table the non-combatant Royal Army Medical Corps stands fifth in order of "merit" and leaves many combatant corps far behind.

The Army and the medical profession owe a debt of gratitude to the authors of this most interesting volume. A. C. H. G.

RESEARCHES PUBLISHED FROM THE WARDS AND LABORATORIES OF THE LONDON HOSPITAL DURING 1930. London: H. K. Lewis & Co., Ltd. Price 7s. 6d.

We have received from the London Hospital a copy of the published researches for 1930. There are thirty-eight separate papers and they cover a wide field in surgery, medicine, gynæcology, physiology, pathology and biochemistry. The papers have already appeared in various journals or in the Proceedings of Societies before which they have been read.

It is difficult to select examples from the large variety of researches published. An outstanding work is "The Significance to Clinical Medicine of Studies in Calcium and Phosphorus Metabolism," by Dr. Donald Hunter, and read by him in the three Goulstonian Lectures of 1930. There is an excellent critical review of disseminated sclerosis, by Dr. W. Russell Brain, which appeared in the *Quarterly Journal of Medicine.* Psittacosis is dealt with in several papers. Dr. J. O. Bland describes an interesting series of experiments on glandular fever. During the epidemic of the disease in London, early in 1930, he carried out various animal experiments, with negative results except in the case of a rabbit inoculated with citrated blood from a man suffering from glandular fever. After an incubation period of eleven days the animal developed fever, anæmia and wasting, and eventually recovered. On the sixteenth day after inoculation blood was removed from this animal and injected into other rabbits and, up to the time of the report, eight passages in twenty-one animals had been carried out. The symptoms in these animals were fever, after an incubation period, anæmia, leucopenia with monocytosis, enlargement of lymph glands, and of the spleen and liver, and the production of focal necrosis in these organs.

Space does not permit of further extracts from many useful papers.

THE PHYSICAL AND RADIOLOGICAL EXAMINATION OF THE LUNGS. By James Crocket, M.D., D.P.H., F.R.C.P.E. Second Edition. London: H. K. Lewis & Co., Ltd. 1931. Demy 8vo. Pp. x + 296. 151 illustrations, including 40 plates. Price 16s. net.

This volume is the successor to one published nine years ago, which means that it is to a large extent a new book. That it will be appreciated as much by students as its predecessor has been, cannot be doubted.

The greater part of the volume is devoted to a description of the various methods of physical examination of the chest with an interpretation of

their results. Then follow four chapters on X-rays in the diagnosis of lung conditions, silicosis and bronchography. Chapters on the larynx in pulmonary tuberculosis and a classification of the stages of the condition, with a glossary of terms and signs used in the physical examination of the lungs, complete the book.

Primarily intended for students of medicine, the work will be found extremely useful by most practitioners; it is written from a practical point of view, and is the result of keen observation and a wide experience in the examination of cases. The X-ray reproductions are good, and as references for future comparisons and readings are well chosen. It is interesting to note that the author does not think the examination of a case complete when tubercular disease of the lung is suspected, unless a thorough radiological examination is made; he considers a series of examinations to show the progress of the case is desirable.

The volume is produced in the admirable way one associates with Messrs. Lewis's publications.

Practical Methods in the Diagnosis and Treatment of Venereal Diseases (for Medical Practitioners and Students). By David Lees, D.S.O., M.A., M.B., D.P.H., M.R.C.P. Second Edition Edinburgh: E. and S. Livingstone. 1931. Pp. xx + 634. Price 15s net.

In the second edition of this valuable book the diagnosis and treatment of venereal diseases are brought up to date.

There are 313 pages devoted to syphilis in all its aspects and excellent coloured plates to assist in diagnosis. The courses in treatment are tabulated all through. It is noted that the dose of bismuth given with good results is larger than is usual in Army methods. The use of tryparsamide in neuro-syphilis is strongly advocated as the most active arsenical preparation in such cases.

A short chapter on soft chancre and bubo gives the routine methods of treatment.

A full account of gonorrhœal diagnosis and treatment in both sexes and children completes the book.

There are 634 pages written with sufficient dogmatism to make the book valuable for students; it can also be recommended as a useful reference book for qualified practitioners.

A. T. F.

Respice—Prospice. Lewis's, 1844-1931. London: H. K. Lewis and Co. Ltd. Pp. 32.

Messrs. H. K. Lewis and Co., Ltd., Booksellers and Publishers, Gower Street, London, have issued an illustrated booklet describing the new premises which have recently been opened and giving a short history of the firm.

In 1844 the late Mr. H. K. Lewis took over the shop, 15 Gower Street, where a bookselling, stationery and newspaper business was carried on. He began a circulating library and gradually developed the business into the bookselling and publishing house now known throughout the medical world.

The new building gives much increased accommodation for all departments of Messrs. Lewis's establishment and especially for the well-known circulating library, which now includes a reading room, where subscribers have writing accommodation and may have any number of books and medical publications for reference.

FELLOWSHIP EXAMINATION PAPERS FOR THE DIPLOMA OF THE ROYAL COLLEGE OF SURGEONS, EDINBURGH, 1927-1930. Edinburgh: E. and S. Livingstone. Pp. 75. Price 1s. 6d.

This is a collection of the questions asked at the Edinburgh Fellowship for the four years 1927-30. They are grouped under the different subjects and form an excellent guide for candidates for the examination; they are also extremely useful for anyone who has to set papers in surgery.

Notice.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE
(UNIVERSITY OF LONDON).

THE next series of eight Lectures and Demonstrations on Tropical Hygiene, which are intended for men and women outside the medical profession proceeding to the Tropics, will be given by Lieutenant-Colonel G. E. F. Stammers, O.B.E., M.R.C.S., L.R.C.P., D.P.H., from October 21 to 30, 1931.

These courses of instruction, in addition to providing simple rules for guidance in regard to preparation for life in the Tropics and personal hygiene, will also embrace a short account of some of the more common diseases, with advice in regard to measures of protection against such diseases and some guidance in simple methods of self-treatment.

The Synopsis and other particulars can be obtained from the Secretary, London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed 'Holt & Co.'

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C. 2.

VOL. LVII. NOVEMBER 1931. No. 5.

Journal of the Royal Army Medical Corps.

Original Communications.

CEREBRO-SPINAL FEVER IN THE ALDERSHOT COMMAND.

BY MAJOR C. ARMSTRONG, M.B.E.; MAJOR J. B. FOTHERINGHAM; MAJOR A. HOOD; MAJOR C. J. H. LITTLE, O.B.E.; AND MAJOR T. O. THOMPSON.

Royal Army Medical Corps.

INTRODUCTION.

THIS article is an endeavour to place on record our experience in the diagnosis and treatment of cases of cerebro-spinal fever seen during the first seven months of 1931 in the Aldershot Command, with notes on the administrative action required and the measures adopted to prevent spread of the disease.

No case of cerebro-spinal fever had occurred in the Aldershot Command since early in July, 1930, when there was one sporadic case.

The total number of cases in this series is thirty-four. Thirteen cases died—a mortality of 38·2 per cent.

As the incidence of cerebro-spinal fever has increased steadily for the past eight years amongst the civil population (Ministry of Health Reports on Public Health and Medical Subjects, No. 65, page 6—published by the Stationery Office, 1931), it is hoped that these notes may prove helpful to Royal Army Medical Corps officers who may be called upon to deal with future outbreaks of this disease.

SECTION I.

BY MAJOR C. ARMSTRONG, M.B.E.,
Royal Army Medical Corps,

AND

MAJOR J. B. FOTHERINGHAM,
Royal Army Medical Corps.

CLINICAL ASPECTS.

The total number of cerebro-spinal fever cases admitted to the Military Isolation Hospital, Aldershot, during the period January 1, 1931, to July 31, 1931, was thirty-four (one case was treated at another hospital). Of these, twenty-four were diagnosed bacteriologically and ten clinically.

It is necessary to make it perfectly clear at the outset that the cases diagnosed clinically were, without reasonable doubt, cases of cerebro-spinal fever. These cases were, in several instances, more severe types of the disease than some of the cases in which meningococci were present in the cerebro-spinal fluid. The following examples are illustrations of this :—

Case 23.—Mild case diagnosed bacteriologically and clinically.

Case 28.—Mild case diagnosed clinically.

Case 32.—A possibly fulminating case diagnosed clinically.

Case 23.—Onset the day before admission with headache, vomiting, pain in the back of the neck, and in the lumbar region. Headache mainly frontal. On admission to hospital, temperature 100° F., pulse 108. Face rather expressionless. Tongue furred. Some photophobia. Pain and stiffness in posterior cervical muscles on attempting to bend head forward. Kernig's sign present. Lumbar puncture under local anæsthesia and twenty cubic centimetres of thick cerebro-spinal fluid under slightly increased pressure removed. Meningococci were present in smears from the cerebro-spinal fluid.

This patient was given Type I serum during the first four days of his illness and made an uneventful recovery except for some asthenia.

Case 28.—Patient felt all right until the day before admission when he developed a headache and suffered from general malaise. He felt worse next day and commenced to have intense headache, photophobia and vomiting. On admission temperature 101° F., pulse 86. Face flushed. No stiffness in neck muscles but pain on bending head forward. Severe frontal headache. No lung, cardiac, or abdominal symptoms. No pupil changes. Abdominal reflexes present. Kernig's sign present. Knee-jerks absent. Plantar reflex flexor in type. Lumbar punctured and fifty-five cubic centimetres of turbid cerebro-spinal fluid removed. Pressure increased, etc.

This patient during the acute stage of his illness had delirium, an herpetic rash under the chin, marked head retraction and opisthotonos. He is now convalescent and has had no complications.

Case 32.—Onset the day before admission, with headache and general malaise. The headache became steadily worse and he later developed pain and stiffness in the neck and back associated with vomiting. On admission his temperature was 101·6° F., pulse 108, respirations 26. Face a little flushed. Tongue furred. No lung, throat, cardiac or abdominal symptoms. Photophobia severe and patient very hyperæsthetic to touch and cold. No rash. No pupil abnormality. Abdominal reflexes present. Knee-jerks normal. Kernig's sign present. Neck a little stiff and he had difficulty in placing his chin on the chest. Lumbar punctured and thirty cubic centimetres of clear cerebro-spinal fluid removed. Pressure increased, etc.

This patient speedily became very ill indeed, was semi-comatose for over twenty-four hours, and developed a transient external strabismus of his left eye. He had considerably more head retraction and opisthotonos than usual and required frequent lumbar puncturing and much serum administration in the early stages of his illness. He is now approaching convalescence.

BACTERIOLOGICAL REPORTS ON THE EXAMINATION OF THE BLOOD, CEREBRO-SPINAL FLUID, ETC., OF THE CASES NUMBERED 23, 28, AND 32.

Case 23.—May 5, 1931. Leucocyte count not done. Cerebro-spinal fluid: cells nil per cubic millimetre. Sugar: normal reduction of Fehling solution. Smear: meningococci present. Globulin: no increase. Culture: sterile.

May 7.—Cerebro-spinal fluid: cells 1,800 per cubic millimetre. Smears: meningococci present, intracellularly only. Globulin: increased. Culture: sterile.

Case 28. July 11. Leucocyte count: 15,400 per cubic millimetre; polymorphs 78 per cent; lymphocytes 19 per cent; mononuclears 3 per cent. Cerebro-spinal fluid: cells 13,500 per cubic millimetre; polymorphs 95 per cent. Globulin: increased. Smears: no organisms seen. Culture: sterile.

Case 32. July 25. Leucocyte count: 13,000 per cubic millimetre; polymorphs 77 per cent; lymphocytes 20 per cent; mononuclears 3 per cent. Cerebro-spinal fluid: cells nil per cubic millimetre. Sugar: no reduction of Fehling solution. Globulin: no increase. Smears: no organisms seen. Culture: sterile.

In connection with these clinical diagnoses of cerebro-spinal fever it is of interest to note the following extract from Ker's "Infectious Diseases," Third Edition, 1929, p. 560:—

"The question has been raised if it is justifiable to call a case cerebro-spinal meningitis if meningococci cannot be found. In my opinion it may be quite legitimate to do so. Given a turbid fluid, polymorphs, signs of

meningitis, and such a symptom as herpes, for example, it is difficult to see what else the condition can be, especially if it is followed by recovery. The septic cases do not recover, and the micro-organisms which cause them are much less likely to be missed in the fluid than is the very delicate meningococcus."

It is our considered opinion that the cases diagnosed clinically were undoubted cases of cerebro-spinal fever.

Diagnosis.

It is not proposed to discuss the differential diagnosis of cerebro-spinal meningitis from the various forms of meningitis, but it is well to remember that some of the acute infectious diseases, particularly influenza, may simulate cerebro-spinal fever if toxæmia leading to cerebral symptoms is present. If the cardinal symptoms of headache (with or without delirium), vomiting, stiffness of the neck and a positive or even a doubtful Kernig's sign are present, then it is imperative that the patient be lumbar punctured without delay. It is advisable also to carry out a total and differential leucocyte count of the blood as quickly as possible, as a high leucocytosis is almost the rule in cerebro-spinal fever (12,000 to 40,000), and this test is useful in differentiating typhoid fever which may simulate cerebro-spinal fever if there is much early toxæmia. Pyrexia at the onset of an attack of cerebro-spinal fever is almost always present, but it is of no value in differential diagnosis.

With regard to fulminating cases, diagnosis at the very onset is frequently extremely difficult, particularly apart from an epidemic. Although headache and vomiting may be accompanied by fever, the temperature may be subnormal. Rigidities, e.g., Kernig's sign and stiff neck, may be absent. Continuous retching and vomiting, diarrhœa or incontinence of urine and fæces, together with the suddenness and extreme severity of the onset, are very suggestive. Lumbar puncture should be done at the earliest possible moment and, even if the macroscopic appearances seem to put cerebro-spinal fever out of court, serum should be given. A few hours later the diagnosis may be obvious, e.g., development of the petechial or purpuric rash, but the gain of these hours may turn the scale in the patient's favour. Apathy, lethargy and coma would seem to be characteristic of these cases rather than irritability and delirium.

Petechial and purpuric rashes, whilst the commonest, are not the only rashes associated with cerebro-spinal fever. In several cases of this series an eruption of large rose-coloured macules was noted, especially about the shoulders, arms and shins. Some observers described this rash as being papular. These rose spots may be comparatively few or the reverse, but they are extremely evanescent. They have been noted mixed with petechiæ. Herpetic eruptions on the face are not uncommon, but generally tend to occur a few days after the onset. In one case a very intense erythema was

noted in the first forty-eight hours, but may have been due to causes other than cerebro-spinal fever.

It is most important to note that the finding of a clear cerebro-spinal fluid without increase of pressure at the initial lumbar puncturing does *not* negative a diagnosis of cerebro-spinal fever. In some cases where this occurs the diagnosis may be made with certainty on clinical grounds, but in others the clinical signs are indefinite, and in such cases it is better to avoid delay in waiting for laboratory findings (which at this stage may not be conclusive) and to administer serum.

Case 15, a private of the Royal Tank Corps, aged 26, is recorded as an illustration of the difficulties of diagnosis.

"Patient was admitted to the Cambridge Hospital on February 20, 1931, and diagnosed 'influenza.' Entry on A.F. B.178 states 'two days pyrexia, headache and general pains.' Salicylate mixture given, recovered. On day of discharge (February 27, 1931), developed rigor, headache, stiff neck and macular rash. Hæmorrhagic spot on soft palate and a sub-conjunctival hæmorrhage. Transferred to Military Isolation Hospital as ? cerebro-spinal fever. On admission to Military Isolation Hospital (February 27, 1931) a macular rash was noted, generalized but not profuse, mostly on the arms and legs (especially the forearms and shins). The rash was not petechial; the elements were like the rose spots of enteric fever. Neck stiffness was indefinite, Kernig's sign absent, and there was no vomiting, temperature 101·2° F., pulse 112."

Lumbar puncture was done at once. The cerebro-spinal fluid was clear and the pressure not increased. Laboratory report on cerebro-spinal fluid: nineteen cells per cubic millimetre (sixty-one per cent being large endothelial cells); no micro-organisms seen in smears; no increase of globulin. Blood was taken for culture. Both the blood and the cerebro-spinal fluid remained sterile. No serum administered.

On the morning of February 28, 1931, patient was much better, with no headache or vomiting and no suspicion of rigidities. The rash had completely gone (temperature 97·8° F., pulse 80). Patient remained comfortable and condition unchanged through that day, and on Sunday, March 1, his condition being still satisfactory and the negative culture reports of the blood and cerebro-spinal fluid having been received, patient was re-transferred to the Cambridge Hospital.

There he remained quite well up to the evening of March 4, when he developed a rigor (temperature 104° F.). Malaria was suspected but no malaria parasites were demonstrated in blood-films.

There was no pyrexia on March 5, but a rigor occurred on March 6, accompanied by headache; there was no other supporting evidence of cerebro-spinal fever. On the evening of March 7, temperature was 100·2° F., pulse 64; headache, vomiting and positive Kernig's sign developed. Lumbar puncture was performed and the cerebro-spinal fluid was found to be under pressure and turbid. Type I meningococcus was isolated from the cerebro-

spinal fluid. Note: This case has been classed in Table II as a mild form of cerebro-spinal fever with a severe recrudescence. This would appear to be the most likely explanation of the sequence of events.

Sugar in the Cerebro-spinal Fluid.

As the property of a normal cerebro-spinal fluid to reduce Fehling's solution is lessened or lost in acute meningeal conditions, a rapid test at the bedside of the cerebro-spinal fluid withdrawn at the diagnostic lumbar puncture is, in our opinion, a useful procedure, especially if the fluid is clear and it is doubtful whether anti-meningococcus serum should be administered intrathecally or not.

The Fehling's solution is diluted 1 in 4 with distilled water and three times as much cerebro-spinal fluid is boiled up with it. If there is reduction of Fehling's solution (providing the cerebro-spinal fluid is clear and the clinical signs indefinite) a strong point against the diagnosis of cerebro-spinal meningitis is made and serum might be withheld. If there is no reduction of Fehling's solution and the general symptoms are suspicious, serum should certainly be given even if the cerebro-spinal fluid is clear and the pressure not increased. This bedside clinical test is of even greater use in settling the difficult question that often arises about seven to ten days after the onset thus:—

The patient appears to be progressing satisfactorily and the cerebro-spinal fluid withdrawn at the last lumbar puncture is clear and no micro-organisms are found. Forty-eight hours or so later there is a sudden rise of temperature and patient complains of headache. Rigidities, which are almost certain to be still present at this stage, may have become more marked. A recrudescence of the disease is suspected, lumbar puncture is performed and the fluid found to be opalescent or even turbid. If this cerebro-spinal fluid definitely reduces Fehling's solution, it may be assumed that the meningeal irritation and the turbid fluid are due to serum sickness, that serum may and should be withheld, and finally that the outlook is favourable. If there is no reduction of Fehling's solution, the suspicion of a recrudescence of the disease is given immediate confirmation and serum should be given intrathecally. Everything required for the test should of course be prepared before lumbar puncture is done, and a sample of the cerebro-spinal fluid should be sent to the laboratory in any case.

Other Characters of the Cerebro-Spinal Fluid.

With regard to the naked-eye appearance, quantity, and pressure of cerebro-spinal fluid, the following points were noted:—

Steady diminution in amount of cerebro-spinal fluid obtainable at the successive lumbar punctures was found to be a bad omen.

Turbidity or clarity of itself signified little; moderately turbid fluids might be found to show 3,000 cells per cubic millimetre and no organisms,

whereas clear fluids might prove to be emulsions of meningococci. Golden yellow cerebro-spinal fluid, usually scanty in amount, which clotted almost immediatetely after withdrawal, was of bad prognostic significance. The least markedly increased pressures were noted in fulminating cases, and in three of these the fluid was crystal clear.

Prognosis.

One can only give a very guarded prognosis in any case of this disease. Severe initial symptoms with early loss of consciousness, much delirium, and a hæmorrhagic rash make the prognosis grave. The milder the onset and the earlier serum treatment is commenced, the better the prognosis.

Treatment.

(1) *Serum Administration and Lumbar Puncture.*

The first twenty-three cases and Case 34 were treated with polyvalent antimeningococcal serum from many different firms, and of these cases thirteen died. Then a Type I serum, prepared by the Lister Institute from strains of meningococcus isolated earlier in the outbreak, was received and taken into use in the remaining ten cases, and there were no more deaths. All cases were classified clinically under one of the following heads: fulminating, possibly fulminating, superacute, ordinary (i.e., acute) or mild (see Table II). The writers realize that the term "possibly fulminating" is difficult to defend, but are of opinion that infections described as such were almost certainly fulminating cases diagnosed and treated very early and aborted in a somewhat dramatic manner by the specific serum.

It is instructive to compare the classifications and results of the two series of cases, and for this purpose it is perhaps fairer to eliminate the definitely fulminating cases from amongst the first twenty-four patients, and to lower those called "possibly fulminating" to the class of "super-acute."

TABLE I.

	Serum administered: Polyvalent	Serum administered: Type 1
Number of cases (24-5 fulminating)	19	10
Death rate per cent	42·1	*Nil*
Superacute per cent	26·3	50
Ordinary per cent	63·1	40
Mild per cent	10·6	10

It will be seen from this Table that ninety per cent of the cases in each series were either superacute or ordinarily acute, but whilst those treated with polyvalent serum had a mortality of forty-two per cent, there were no deaths amongst the cases receiving Type I serum. In this connection it is important to note that the laboratory investigators report in Section II that they found no agglutinins for the local strains of meningococcus in three brands of polyvalent serum.

As regards the methods of administration, we have given the serum

intrathecally in all cases, and in almost every case intravenously as well. In the more serious cases the serum was given intrathecally, intravenously and intramuscularly. In one or two cases the subarachnoid space was irrigated with normal saline, but this has not been regarded as a method of choice. As a rule the initial lumbar punctures were carried out under local anæsthesia with or without the prior administration of $\frac{1}{4}$ grain morphia, but frequently a general anæsthetic was necessary. It was often possible to carry out the lumbar punctures under local anæsthesia for the first two or three punctures, but after that a general anæsthetic was usually imperative. Many patients were delirious and could not easily be controlled, and others became so hyperæsthetic as to make general anæsthesia a necessity.

In this connection it should be noted that it is not merely the lumbar puncture that is painful, the introduction of serum into the subarachnoid space is frequently intolerably so; moreover maintaining the correct posture (knees drawn up, etc.) for over half an hour or more often results in agonizing cramps. The intravenous administration of serum often induces, through changes in blood-pressure, a feeling as if the head were bursting.

In practice it will, we think, be found that general anæsthesia as a routine saves time in the long run (see Claude Ker's "Infectious Diseases," Third Edition, p. 569). For general anæsthesia we used chloroform, followed by either a C.E. mixture or open ether.

Intrathecal injection should be performed with very great care—about one cubic centimetre in half a minute—an assistant giving warning as to any change in pulse-rate and tension. For local anæsthesia, one per cent planocaine was generally employed. Lumbar punctures were made in the fourth lumbar interspace in all cases in the first instance, but later punctures were frequently made in the third lumbar interspace if there was difficulty owing to adhesions, or other cause, in withdrawing fluid from the lower site. (In no case of the series was there sudden death due to increased intracranial pressure following serum administration intrathecally.)

It is advisable to have oxygen and the usual hypodermic stimulants at hand in case of collapse. Caffeine sodium benzoate was found a reliable cardiac and respiratory stimulant.

We are omitting many details of the routine treatment and general management of cerebro-spinal fever patients which will be familiar to all, but attention is directed to the following points:—

Probably the most important point is the typing of the meningococcus and the administration as early as possible of serum prepared from the homologous type strain. The difference between the results in the two divisions of this series of cases speaks for itself. (Refer to beginning of section on treatment.) In dealing with an epidemic where the predominant type is already known, the homologous type strain serum should be given

from the beginning, the infecting strain in a particular case being, of course, checked. In a sporadic case, or at the beginning of a future outbreak, polyvalent serum of *undoubted potency* is an urgent necessity until the type of the meningococcus is determined.

As recovery of the organism is no easy matter, *every* source—cerebro-spinal fluid, blood and nasopharyngeal swabs—should be tried early.

Lumbar puncture, with or without administration of serum, is the great stand-by, not only in treatment, but in gauging the progress of the case. One might summarize the treatment by saying:—

(*a*) Puncture early and often.
(*b*) When in doubt, puncture.

If a patient does not react to two or three intrathecal administrations of one brand of anti-meningococcal serum, try another brand. Such a change was followed by most successful results in several cases of this series when polyvalent serum only was available.

(2) *Dosage of Serum.*

For intrathecal injections this has depended on several factors, of which the amount of cerebro-spinal fluid withdrawn is easily the most important.

These factors in order of importance are as follows:—

(*a*) The amount of cerebro-spinal fluid withdrawn.
(*b*) The condition of the cerebro-spinal fluid.
(*c*) The severity of the case.
(*d*) The condition of the patient.

If seventy cubic centimetres of cerebro-spinal fluid were removed at one puncture, then fifty to sixty cubic centimetres of serum were given intrathecally; but if fifteen cubic centimetres were removed, then ten cubic centimetres of serum were given. In patients approaching convalescence, when perhaps two to ten cubic centimetres of cerebro-spinal fluid were withdrawn, serum was not given intrathecally, but by the intravenous or intramuscular route. In other words, the greater the intracranial pressure the greater should be the difference between the amount of cerebro-spinal fluid removed and the amount of serum given intrathecally. The clinical condition of the patient was not always a reliable guide, unless taken in conjunction with the condition of the cerebro-spinal fluid. It is this which makes it so difficult to know when to give and when to withhold serum. We consider that all cases, except the mildest, require to be lumbar punctured daily and given serum intrathecally for the first four days of the illness. In fulminating and severe cases we have found it necessary to lumbar puncture three times in twenty-four hours. It happened in one or two instances that serum had to be given to a patient after a lapse of seven days from a previous administration. In such cases the patient was given a desensitizing dose of 0·5 cubic centimetre of serum in normal saline a few hours prior to being given the therapeutic dose of serum, as a precaution against anaphylactic shock.

General Treatment and Management.

In addition to the serum treatment of these cerebro-spinal fever patients general symptomatic treatment was carried out.

Morphia was found necessary for most patients to ensure rest and lessen pain. It was given fairly freely with, it is thought, beneficial results when headache, delirium, pain and restlessness were severe. When possible, these symptoms were controlled by means of chloral and bromide draughts, "allonal," or aspirin.

Retention of urine was a very common complication and patients required careful watching and catheterizing when necessary. Urotropine fifteen grains four-hourly for the first twenty-four hours and three times a day after that, was given to a considerable number of cases as a routine measure during the acute stages.

If anti-meningococcal serum is not procurable or available, a solution of urotropine, one grain to one cubic centimetre, may be given intravenously in dosages of fifteen to twenty cubic centimetres. It may, of course, be used in conjunction with serum treatment.

Calcium lactate, ten grains, was also given t.i.d. to almost all patients, but appeared to have little or no effect in preventing serum sickness, which occurred in most cases of the series.

Naturally, in many instances, there were periods during the acute stage where it was impossible to give drugs by the mouth because of delirium, loss of consciousness, etc. When patients became convalescent they were given a full diet with the usual tonics—malt and cod-liver oil, etc.

Careful watch for recrudescence or intercurrent relapse must be maintained. One case in this series had a severe recrudescence after nine days' normal temperature, and in the meantime he had so far improved that his name had been removed from the Dangerously Ill List. Fortunately, he recovered. There was no case of true relapse in the series.

There were no serious complications such as would have rendered any patient who recovered permanently unfit for military service. When convalescent, two negative nasopharyngeal swabs were required before a patient was discharged from hospital; he then received two months' sick leave, at the end of which he was medically examined before resuming duty with his unit.

Hypersensitiveness to Cold.

Cerebro-spinal fever patients feel cold to a very marked degree and in severe weather care must be taken in this connection, particularly as broncho-pneumonia is a common complication. The ward should be kept warmer than the usual 60° F., especially when lumbar puncture is being performed, as a large skin area is unavoidably exposed during this operation.

This hypersensitiveness and susceptibility to cold should not be lost sight of when transferring cases from the General to the Isolation Hospital, and every precaution must be taken to minimize any risk.

Protection of Staff, etc.

Nurses, orderlies, chaplains, medical officers, and also relatives visiting dangerously ill patients, should be protected from infection by wearing gowns, and face masks to cover the mouth and nose. The masks may be made of lint or several thicknesses of gauze. Elastic loops to slip over the ears should be sewn on. The masks should be wrung out in fifty per cent eusol or similar antiseptic just before use. The hands should be thoroughly washed on leaving the ward and a $\frac{1}{5000}$ potassium permanganate (in saline) gargle and nasal insufflation used.

In view of the preference of this disease for young people, nurses and orderlies should, so far as possible, be detailed from the older rather than the younger members of the staff. Nurses, orderlies, and others in attendance on cerebro-spinal fever cases should avoid association with children in their off-duty time, and as much of this should be spent in the open air as circumstances permit. Married orderlies living out should not be employed on cerebro-spinal fever cases, or if so employed should live in the hospital.

Periodical swabbings of the nasopharynx of all attendants may be considered advisable.

Extra Personnel.

The necessity for re-inforcing the normal establishment of the Isolation Hospital on an outbreak of cerebro-spinal fever must be remembered. Extra nurses, orderlies and medical officers will be required according to the scale of the outbreak. One cerebro-spinal fever patient may require the attendance of two orderlies by day and two by night, for nursing and restraint, and reliefs; time for meals and normal off duty hours have to be provided. In this connection the remarks in the Ministry of Health Report on Cerebro-spinal Fever, No. 65, should be read.

Treatment of Carriers.

From January 1 to July 31, 1931, 130 meningococcus carriers were admitted to the Military Isolation Hospital, Aldershot, for treatment.

January	1	
February	17	(includes 2 officers and 1 woman)
March	7	
April	10	(includes 1 woman and 3 children)
May	23	
June	9	
July	63	
Total ..	130	

None of these carriers developed cerebro-spinal fever, and the fact that they were harbouring meningococci in the nasopharynx appeared to have no effect on their general health. It was not possible to single out various carriers with slight nasopharyngitis and attribute this to the local effect of the meningococci. One frequently met cases of mild naso-

pharyngitis in healthy people, and it is considered that the irritation of the potassium permanganate solution used in gargling and nasal douching caused mild nasopharyngeal symptoms in a few of the carrier patients.

Nasopharyngeal swabs were taken every fifth day, and patients were discharged from hospital to duty after one negative swab. Of the 130 carriers admitted, thirty-one were still under treatment in hospital on July 31, 1931, and the average number of days under treatment of the ninety-nine cases discharged from hospital was 11·27.

The majority of carrier patients were treated as follows: Nasal douching and gargling with a 1 in 5,000 solution of potassium permanganate in normal saline twice daily, immediately followed by twenty minutes exposure in a special room where a one per cent zinc sulphate solution was vapourized by means of a Levick's spray. This nasal douching and gargling plus zinc sulphate vapour treatment twice daily was known in the hospital as "No. 1 Treatment." A small minority of the carriers were treated with the permanganate solution, gargling and nasal douching three times daily without any zinc sulphate treatment. This was called "No. 2 Treatment." A very small number of patients purposely received no treatment in any form.

The results of these methods were as follows:—

Number of carriers		Type of treatment		Average stay in hospital
81	..	No. 1	..	11·22 days
12	..	No. 2	..	11·41 ,,
6	..	Untreated	..	11·66 ,,
99				

All carrier patients as far as possible were employed in open-air fatigues. There were only five who remained under treatment for over three weeks before the nasopharyngeal swabs became negative. The longest period before a negative swab was secured was thirty-eight days. The wards in which these carriers were accommodated were well ventilated and the beds widely spaced apart.

As the outbreak opened with a somewhat alarming rush of cases, it was considered advisable to prepare for a widespread epidemic. Such an epidemic would necessitate the erection of spray rooms for the wholesale disinfection of units showing a high carrier-rate, on the principles which proved so successful in the outbreaks in the Army during the war, and an experimental spray room was hastily erected. For this purpose one end of a large well-ventilated room in a building near the laboratory was cut off by a temporary wooden partition reaching from floor to ceiling, and a false ceiling of canvas put up to form a room measuring 20 feet by 10 feet by 10 feet. The conversion was completed in forty-eight hours. Two Levick's sprays placed on small tables towards each end of the room produced a satisfactory atmosphere in this space, using a solution of one per cent zinc sulphate. The Clothing Factory, Pimlico, issued "Gowns, germ-proof," and, somewhat unhappily, "aprons, mortuary," for the protection of the

TABLE II.

Clinical Questions	Case 6	Case 7	Case 14	Case 15	Case 23	Case 28	Case 32
1. Were the cardinal symptoms of headache, vomiting and fever present at onset?	Headache; vomiting; T. subnormal	Yes	Yes	Rigor and headache	Yes	Yes	Yes
2. Temperature at onset?	96°	105°	102°	101·2°	100°	101°	101·6°
Pulse?	112	120	64	112	108	86	108
3. Delirium or comatose condition early in illness?	Coma early	No	No	No	No	Yes	Yes
4. Was neck rigidity or pain in back of neck present before initial lumbar puncture?	No	Yes; slight	Yes	Stiff neck	Yes	Yes	Yes
5. Was Kernig's sign present before initial lumbar puncture?	No	Kernig slight	No	No	Yes	Yes	Yes; slight
6. Was photophobia present?	No	Yes	Not marked	No	Yes	Yes	Yes; marked
7. Was patient hyperæsthetic?	No	Yes; not marked	Yes	No	Not especially	Not especially	Very
8. Was any rash present in first 48 hours?	Purpuric	Scanty petechial	Petechial	Macular	No	Herpetic	No
9. Mental condition during acute stage (childish, irritable, apathetic or unchanged)?	Apathetic then comatose	Apart from anxiety very little change	Little change	Clear; unchanged	Apparently unchanged	Apparently unchanged	Very irritable
10. What was the appearance of cerebrospinal fluid removed at initial lumbar puncture?	Absolutely clear; no positive pressure	Clear	Turbid	Clear	20 c.c. clear, pr. increased	50 c.c. turbid, pr. increased	30 c.c. clear, pr. increased
11. Were meningococci found in culture or smear from cerebrospinal fluid?	No	Yes; smear only	Yes; both	On relapse; yes, in culture	Yes, in smear	No	No
12. Did patient pass into chronic stage of cerebrospinal fever?	N.A.	No	No	To some extent	Yes; to some extent	No	No
13. Were there any complications other than the usual bladder weakness and serum weakness?	No	Arthritis knees; left shoulder	No	No	No; except asthenia	[No	No; except transient strabismus
14. Were there any relapses?	N.A.	No	No	Yes; see detailed case-record	No	No	No
15. Was patient diagnosed clinically or bacteriologically?	Clinically	Both	Both	At onset suspected clinically; relapse proved bacteriologically	Both	Clinically	Clinically
16. What were the most marked clinical features during the acute stage?	Extremely rapid development of grave symptoms	Pyrexia; headache; rash; arthritis	Headaches and usual signs; hæmaturia	See case record	Headache	Headache; delirium; rash; opisthotonos	Early comatose condition; hyperæsthesia
17. Duration of acute stage?	18 hours	8 days	11 days	See case record	21 days	9 days	10 days
18. Type of case?* (a) Fulminating (b) Superacute (c) Ordinary or acute (d) Mild	Fulminating	Ordinary	Ordinary	Mild, with severe relapse	Ordinary	Ordinary	Possibly fulminating
19. Result?	Died	Good recovery	Recovery	Died	Recovered	Convalescent	Approaching convalescence

* The classification of the types of cerebrospinal fever is that generally adopted in the standard textbooks on the subject.

NOTE.—Similar forms were completed in detail for each of the remaining cases, but lack of space prevents their inclusion in this table.

clothing of men undergoing treatment (from the vapourized solution). The gowns are long coats of thin waterproof material reaching to the feet, with a hood attached, while the aprons are much the same, but without the hood and with shorter sleeves.

The spray room gave sufficient space for sixteen men to be dealt with at a time, and tests showed that, allowing for time occupied in recharging sprays, and warming them up, and giving each batch of men ten minutes in the chamber, two such batches could be treated every hour, or 256 men in an eight-hour working day. In the case of a widespread epidemic with a high carrier-rate it would be necessary, therefore, to erect such spray rooms all over the area.

SECTION II.

By Major A. HOOD,
Royal Army Medical Corps.

AND

Major C. J. H. LITTLE, O.B.E.,
Royal Army Medical Corps.

A.—Laboratory Investigations.

These were carried out in the Aldershot Command.

Results of Culture of Cerebro-spinal Fluid.

Number of cases		Meningococcus isolated	Types I		Types II		Not typed
34	..	18	13	14	1	..	4
		1 from blood	1				

The nineteen positive cultures were obtained from Cases 1, 2, 3, 4, 5, 7, 9*a*, 10, 11, 13, 14, 15, 17, 18, 19, 20, 21, 24, 25*a* (from blood). In addition, four cases from which no culture was obtained showed Gram-negative diplococci in films of the cerebro-spinal fluid.

The last eight cases of the series all gave negative cultures. The reason for this lack of success in culture is not at first sight clear, and while errors in technique may have crept in they were not apparent. Clinically, as has been shown, the cases, although on the whole milder, were similar to many from which the organism was recovered, and the cytology of the cerebro-spinal fluid was identical with bacteriologically proved cases. An analysis of the cases in which the cerebro-spinal fluid gave a culture of meningococci show that of eighteen such cultures, five (27·7 per cent) were from fluids obtained at the second lumbar puncture. The last ten cases all received Type I serum at the first lumbar puncture, and it is possible that the failure to obtain cultures was due (*a*) to cases being diagnosed earlier, while meningococci were still scanty and more likely to be confined to the base of the brain and had not yet reached the spinal fluid, and (*b*) to cases receiving a more effective serum at the first lumbar puncture, which considerably lessened

the chances of obtaining a culture later. The first three different brands of polyvalent antimeningococcal serum used in treatment were tested for agglutinins against four of the earlier strains of meningococcus isolated (Nos. 3, 4, 7 and 9), and failed to show any agglutination in twenty-four hours in dilutions of 1 in 25 upwards.

Foster and Gaskell (1916), writing of cases in which the meningococcus was not cultured, state, "As infection by the meningococcus is practically the only purulent infection from which recovery takes place, it is justifiable to conclude that there were cases of epidemic meningitis in which the meningococcus could not be obtained." The last eight cases in our series all recovered.

The medium used was pea-trypagar prepared in the Royal Army Medical College, taken to the bedside in a hot box and the fluid plated direct; at the same time a quantity of fluid was taken in a sterile test tube and kept at 37° C. till placed in the incubator. From the latter specimen cultures were made at twenty-four and forty-eight-hour intervals, and these were frequently positive when specimens taken direct at the bedside were negative. In one instance meningococci were cultured daily for eight days from such a specimen (Case 14).

The plates examined after eighteen to twenty-four hours' incubation generally showed a fairly profuse growth of discrete colonies, perfectly circular, greyish in colour and lenticular, the margin transparent, the centre tending to become heaped up and opaque. Occasionally two different types of colony were found on the same plate: (i) the typical colony above described; (ii) small, pinhead colonies indistinguishable from streptococcal colonies, quite transparent.

Films from these colonies showed that (i) was composed of perfectly-shaped Gram-negative cocci in diplo- and tetra-coccal formation, while (ii) showed Gram-negative cocci staining badly, with many involution forms. Foster and Gaskell (1916) described similar appearances.

For the typing of the meningococci the macroscopic method was used and readings were taken after twenty-four hours in the water bath. The results in our hands were not very satisfactory, the serum seeming to be lacking in type specificity (see Ministry of Health Report on Public Health and Medical Subjects, No. 65, pp. 10 and 11). A certain number of strains were sent to Dr. Mervyn Gordon, St. Bartholomew's Hospital, and to Dr. W. M. Scott, Ministry of Health, who very kindly typed them, and whose results are embodied on p. 334. The prevailing type was Type I (fourteen out of fifteen typed), one case was Type II (Case 14), and five strains were lost in the laboratory before they could be typed.

Chemical and Microscopical Examination of Cerebro-spinal Fluid.

Cell Counts.—In the early stages of the disease the cell count may be of no help in diagnosis; in fulminating cases, dying in twenty-four hours from the onset, the fluid may be clear and the cell count from four to eight per

cubic millimetre, i.e., within normal limits (Cases 6 and 8). At the second lumbar puncture such fluids are generally turbid and contain from 10,000 cells per cubic millimetre upwards. When reacting to serum treatment there may be a sudden and very marked diminution in the number of cells from 10,000 or 20,000 to 500 or 1,000 per cubic millimetre, with a corresponding diminution of turbidity (Case 24). When the case is unfavourable only a small quantity of very thick pus may be obtained (Case 2). Occasionally the fluid clots rapidly.

Increase of Globulin.

This was estimated by the Nonne-Apelt test; in practically all cases a turbid fluid showed an increase, but in the very cases where an increase would be a help in diagnosis, i.e., early cases with a clear fluid and normal cell count, the test showed no increase (Cases 6, 7, and 9).

Types of Cells and Presence of Meningococci.

Films of centrifuged cerebro-spinal fluid stained by Gram's stain and by Leishman's stain were used. In a typical case with turbid fluid these films show large numbers of cells, from eighty to ninety-five per cent of which are polymorphs. Gram-negative diplococci are present in varying numbers, and may be extra- or intra-cellular, or both. Where the organisms are mainly intra-cellular they are generally grouped in batches of cocci in single cells in a manner similar to the gonococcus; when extra-cellular they are scattered and may be very difficult to detect. In very early cases with a clear fluid and a normal cell count the cells may be all lymphocytes and no meningococci may be seen (this may occur in fulminating cases dying in twenty-four hours, e.g., Case No. 6), or perhaps after a prolonged search one or two pairs of extra-cellular cocci are found (Case 7), or after incubation films may show many cocci (Case 8). In the latter case the cocci are extra-cellular, the fluid having acted as a culture medium. Large endothelial cells are frequently seen and may constitute a small percentage of the total in recovery cases.

Apart from culture, the finding of a cerebro-spinal fluid rich in polymorphs and containing Gram-negative cocci may decide the diagnosis at once, but it is desirable to emphasize the fact brought out above, that these examinations may be of no assistance in diagnosis in certain cases; in other words, as in many other instances, negative laboratory results are valueless in the presence of definite clinical evidence.

After serum has been administered intrathecally, the cerebro-spinal fluid obtained at subsequent lumbar punctures should be submitted to the laboratory for examination by all the methods indicated above; such examinations may afford valuable evidence regarding the progress of the case, and even positive cultures may be obtained.

B.—Investigation for Carriers.

Carriers were sought for from two sources.

(1) Contacts of cases.

(2) General population of barrack rooms.

Latterly a third source has been sought for, viz., recruits arriving at a depot, but the number examined at present is very small.

(1) *Contacts.*

At first the examination was restricted to the occupants of beds on either side of and immediately opposite the case and to any special friends of the case; early in February the examination included all men in the same barrack room as the case. West's swabs and pea-trypagar plates were used.

Nasopharyngeal Swabs of Contacts.

	Number examined		Number with meningococci present in culture		Percentage of carriers
Total	1,032	..	90	..	8·7
Period to end of February	333	..	15	..	4·7
Mid-April to end of July ..	509	..	72	..	14·1

When the technique of nasopharyngeal swabbing had been mastered, what looked like practically pure cultures of meningococci were frequently obtained. The meningococcus was identified: (*a*) By its appearance and staining; (*b*) by lack of growth at 22° C., followed by growth of the same culture at 37° C.; (*c*) by its sugar reactions (glucose, maltose and saccharose used); (*d*) by the ease with which it emulsified.

Attempts were made to type meningococci from carriers, but the results were not satisfactory, owing probably to the lack of type specificity of the serum used, the cocci agglutinating to the same percentage titre with more than one type of serum.

(2) *Non-Contacts.*

Nasopharyngeal Swabs.

Unit	Number		Meningococci in culture		Percentage of carriers	Remarks
Infantry	100	..	2	..	2	Carried out early in February after three cases in the unit
Staff and clerks of an office	62	..	2	..	3·4	No cases in unit
Recruits after three months in a depot	206	..	30	..	14·5	Five cases in this depot at various times
Recruits joining depot from civil life	23	..	4	..	17·4	Numbers are too small at present to be of much value but should eventually give some indication of the carrier rate at a particular age-period in civilians

Development of Disease in Carriers.

There were two such cases.

Case 14.—Nasopharyngeal swab taken on February 21, 1931, while a patient in hospital, when the whole Medical Division of the Cambridge

22

Hospital was swabbed. Result, meningococci in culture; swab taken again on February 27, result negative; became ill same day; lumbar puncture fluid on February 28, showed cultures of meningococci (Type II).

Case 33.—Nasopharyngeal swab taken at midday on July 26, as he was a contact of Case 32; meningococci cultured. Later on same day he became ill and was admitted to hospital with cerebro-spinal fever; meningococci were not cultured from the cerebro-spinal fluid.

Both cases were within the incubation period when the positive cultures were obtained.

SECTION III.

By Major T. O. THOMPSON,
Royal Army Medical Corps.

Administrative Aspects.

The noteworthy features of the series of cases from the administrative point of view appear to be as follows :—

(1) *The Predominance of Influenza as a Predisposing Cause.*

Nearly seventy-five per cent of these cases had had influenza a few days or weeks before the onset of cerebro-spinal meningitis, and five cases actually developed this disease while in hospital for influenza. This may, however, have been due to the fact that there had been an extensive epidemic of influenza, and few of the personnel of the Aldershot Command can have escaped infection in a mild or severe form.

The influenza epidemic was moderately severe, commenced on January 5 and lasted to March 25, giving admissions to hospital and barracks for the months January 1 to March 31 as follows :—

Influenza.

Hospital Treatment.

	Officers	Soldiers
January	3	912
February	1	337
March	1	155
Totals	5	1,404

Barrack Treatment.

	Officers	Soldiers	Women	Children
January	51	1,068	66	73
February	43	541	70	92
March..	7	250	13	13
Totals	101	1,859	149	178

(2) *The Widespread and Irregular Incidence.*

The cases have shown little definite sequence and often no connection, but occurred irregularly amongst the whole military population of the Command with the exception of officers.

(3) *Marked Preponderance of Young Subjects.*

The normal predilection of the disease for youth is well shown in this series. The average age of the patients (excluding two children) was just over twenty. The average age of soldiers in the Command is probably not great; but it was particularly noticeable how young the majority of the cases were.

Sixty-six per cent of the cases had only a year's service or less. Does this merely signify that the disease was limited to the younger members of the military inhabitants, or does this really indicate that the disease was due to importation by recruits who infected their companions on joining units or training depots from the civilian population? The fact that ten of the cases actually occurred in the two big recruit training depots in Aldershot certainly seems to indicate that this military series was undoubtedly partly due to repeated importation into the areas of the Command from the civil population, and is borne out by examinations for carriers.

(4) *Influence of Prophylactic Measures.*

The continuance of cases in spite of general prophylactic measures directed against the droplet infection of the influenza epidemic is a point worth noting. By the end of January all the normal preventive measures against influenza infection had been brought into action; and yet, in spite of this, sporadic cerebro-spinal meningitis cases continued to crop up. In fact, the carrier rates appeared to be unaffected by these usual preventive measures. So much so, that the laboratory findings tended to show that the carrier rate was higher in units undergoing rigorous preventive measures than in other units or civilian personnel amongst whom such measures were not being carried out. This may be considered as being due possibly to the fact that either the measures were not carried out seriously or these measures do not produce the beneficial results desired and expected, or possibly that infection was being imported in the majority of cases from civilian sources and caused spread only around each immediate centre of importation.

(5) *Difficulties Inherent in Maintaining Recognized Prophylactic Measures.*

Many orders were repeatedly issued on these subjects, and time and again exact details were pointed out to infected units. Yet, time and again, it has been found that after a short spell of zeal in the observance of the measures, conditions tend to relapse back to the old, old faults of bed spacing, ventilation, utensil sterilization, etc., unless continual personal supervision is exercised. This certainly shows that the need for further hygienic education and training of all ranks remains as great as ever.

(6) *Contacts.*

One special point which requires consideration is, "Who are contacts?" i.e., what limit is to be placed on those who must come under suspicion as being either the source or the potential spreaders of the particular focus

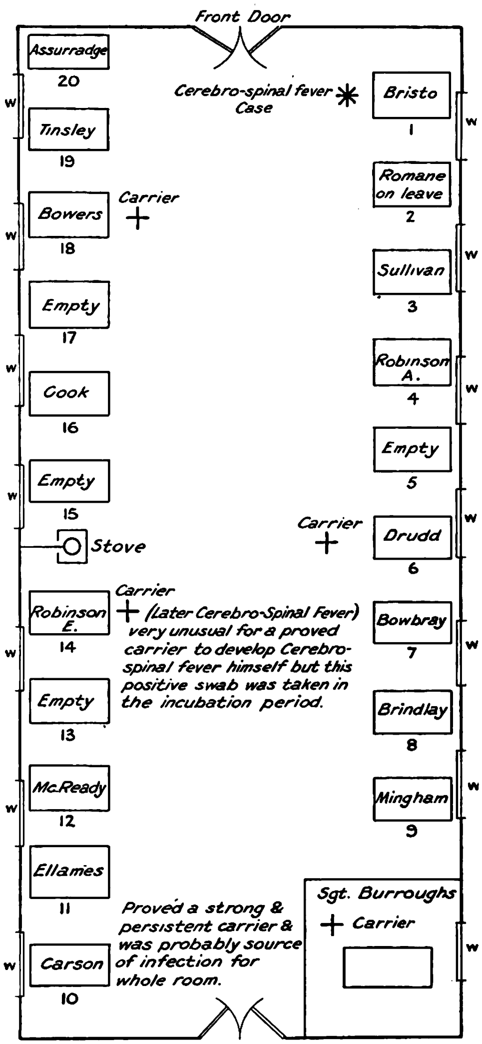


FIG. 1.

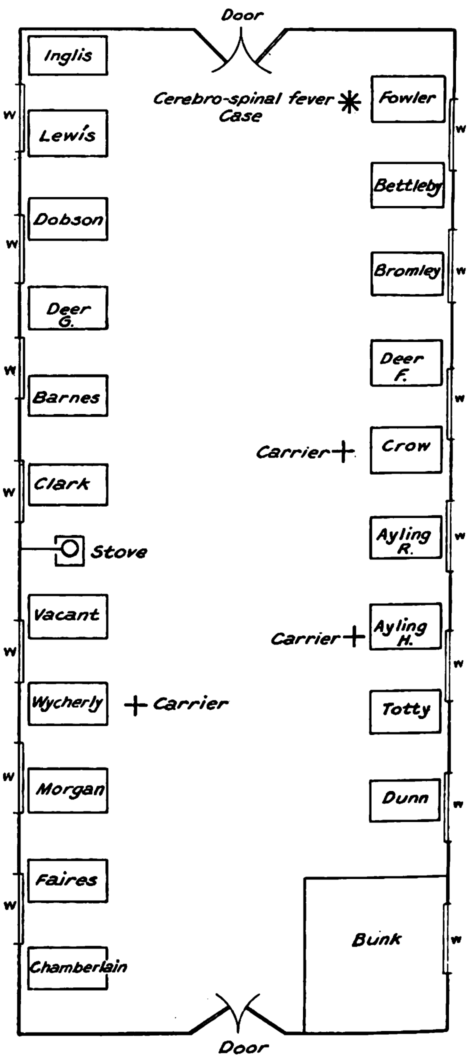


FIG 2.

Hut B1, R.A.M.C. Depot.

under examination? Are contacts to be limited to those occupying adjacent and opposite beds in the barrack room, and to those sitting in adjacent seats at meals, and to special friends with whom the patients may usually associate, and possibly civilian and "lady friends"?

A consideration of the cases under review indicates that it is insufficient

to regard the occupants of adjacent and opposite beds as the sole contacts; and suggests that the whole of the personnel in that barrack room must be thoroughly examined, and in addition all special friends of the patient with whom he may converse at close range. In fact, it seems that infection probably occurs when men are grouped around a fire or other mutual attraction rather than from bed to bed or seat to seat, on which much stress is usually laid. This is supported by the irregular scattering of proved carriers through a "contact barrack room" with no relation to the bed positions, and is illustrated by the diagrams of barrack rooms in which all occupants were examined. Two of these diagrams are selected at random as samples of similar diagrams from the majority of the cases (figs. 1 and 2).

(7) *Incubation Period.*

This, although given as two to five days, sometimes eight days, is said to be prolonged occasionally to ten days, and this series shows the necessity for a definite period which can be regarded as the infective incubation period. That is to say, we should have a definite period of say fourteen days, during which every move of the patient must be ascertained and examined with a view to getting the source and carriers of infection.

It is recommended that fourteen days should be definitely treated as the infective incubation period for purposes of movement and contact.

(8) *Disinfection.*

An examination of the procedure carried out in these cases disclosed that in every case a complete disinfection of the barrack room, floor, furniture, clothing, bedding, etc., was carried out.

Is this to be regarded as necessary for the prevention of the disease, or is it wasted energy and expenditure? It is true that our knowledge of the method of spread is not perfect, but it appears that the method is either as a droplet infection, or direct salivary contact on feeding utensils, or probably both. In addition, the organism is an extremely delicate one and difficult to cultivate. The extent to which we disinfect after the occurrence of a case in a barrack room is therefore probably either entirely unnecessary or far in excess of what need be done.

But can we afford to leave such disinfection not done? Apart from any actual benefit gained, the moral effect on the public mind, on the remaining occupants of the room and on the lay regimental authorities, is such that in our present state of education we cannot afford to eliminate measures which we know or think may be unnecessary and a waste of time and energy.

(9) *Effective Preventive Measures.*

Orders embodying and emphasizing all the usual recognized prophylactic measures were brought into action and, by repetition and keen supervision, were made as effective as possible.

The present series of cases with their concomitant contacts and carriers indicates the following as the order of effectiveness of such measures:—

(1) Investigation of all contacts of a case and examination for carriers, with subsequent isolation and treatment of such carriers.

(2) The examination of all new arrivals for carriers with subsequent isolation and treatment of any found, i.e., the prevention of importation.

(3) Lessened contact at places of congregation, i.e., canteens, church parades, etc.

(4) Ventilation and bed spacing. This preventive measure appears to be of far less importance than grouping or crowding in canteens and round fire-places.

(5) Insufflation of mild disinfecting lotions. This may give good results from mechanical washing.

(6) Routine gargling, as usually carried out, and routine so-called sterilization of cups and feeding utensils, *as carried out,* appear to be quite ineffective for prevention of cases or reduction of carriers.

(10) *Suggested Administrative Action on Occurrence of a Case.*

This series of cases suggests that something on the following lines should be laid down as the action to be taken on the occurrence of a case. The object aimed at is to ensure that uniform action is taken and information obtained for every case, with the object of increasing our knowledge of the methods of spread and prevention of this disease.

A.—*By Medical Officer concerned with Provisional Diagnosis.*

(i) Inform Senior Medical Officer—Officer i/c Laboratory—A.D.M.S. District—D.D.M.S. Command.

(ii) Arrange isolation and removal and treatment of cases.

(iii) Arrange isolation of all probable contacts and possible carriers for investigation by the pathologist.

(iv) Obtain immediately and on the spot an exact history of the suspected patient during the full period of incubation, with all details as to recent movements, habits, recent visits or any other factor bearing on the possible source of infection.

(v) Obtain relevant history of obvious contacts.

(vi) Arrange disinfection of room and material.

(vii) Scrutinize the whole unit sanitation in respect of overcrowding, bed spacing, ventilation, disinfection of feeding utensils and remedy defects.

(viii) Summarize and tabulate information obtained. Prepare a detailed plan of the barrack room roughly to scale, showing bed spacing, contacts, carriers, ventilation and heating arrangements.

(ix) Make "Unit spot map."

(x) Arrange special examination of all new arrivals and special supervision for the control of all preventive measures put in force.

B.—*By Bacteriologist.*

(i) Swab contacts; find carriers.
(ii) Estimate "contact" carriers.
(iii) Estimate "non-contact" carriers.
(iv) Control treatment and cure of carriers.

C.—*By Senior Medical Officer; A.D.M.S. District (D.A.D.H.); D.D.M.S. Command (A.D.H.).*

(i) Co-ordinate and issue orders as to the disposal of cases, carriers and contacts, and the examination of all new arrivals.

(ii) Co-ordinate and issue orders regarding movements of troops, drafts, leave men, courses and training camps.

(iii) Obtain, co-ordinate and *distribute* to military medical personnel *all available information* as to the incidence, locality, severity and spread of the disease amongst the local and distant civilian population.

In conclusion, we wish to thank Major-General J. A. Hartigan, C.M.G., D.S.O., K.H.P., D.D.M.S., Aldershot Command, for facilities afforded us in compiling this report, and to Lieutenant-Colonel W. C. Smales, D.S.O., O.B.E., R.A.M.C., A.D.H., Aldershot Command, for giving us access to the necessary statistics.

———

SIMPLE EYE WORK FROM THE POINT OF VIEW OF THE NON-SPECIALIST.

By Major J. BIGGAM, M.C.,
Royal Army Medical Corps.

(*Continued from p.* 267.)

Fluids used for Irrigations.

The most easily obtained and satisfactory fluid for bland irrigation is normal saline. It is cheap, painless, and always available.

A saturated solution of boric acid may also be used for bland irrigation. Its antiseptic properties are negligible. Normal saline is to be preferred. Mercury seems to have a specific action on Koch-Weeks conjunctivitis and 1 in 20,000 to 1 in 10,000 perchloride of mercury or 1 in 5,000 oxycyanide of mercury may be used for irrigation.

The oxycyanide of mercury lotion in strengths of 1 in 10,000 to 1 in 4,000 is useful in all forms of acute conjunctivitis, particularly the staphylococcal and Morax-Axenfeld infections. If it is used the solution should be made up every week.

Travellers who are subject to eye irritation when moving by road or rail in the tropics, may obtain compressed tablets for making up normal saline or zinc-boric solutions as required on the journey.

Treatment of Chronic Conjunctivitis.

Remedies are innumerable. The following will usually be found satisfactory.

(1) Let the patient make a habit of cleansing the eyes, especially after dusty games, motoring and exposure to dusty winds, with a normal saline eyebath. Time is saved by using two eyebaths simultaneously.

(2) Use the following eye drops twice a day for several days, at intervals as required. They should not be placed in the eyes the last thing at night or they may irritate. A slight feeling of irritation is felt for some minutes after their use at any time.

℞	Zinc sulphate	..	..	1 gr.
	Acid boric ..	..	..	10 ,,
	Adrenalin, 1:1,000	..	..	30 min.
	Distilled water to	..	..	1 oz.

The adrenalin may be omitted if desired.

(3) A little bland ointment rubbed along the lid margins at night will prevent them sticking.

(4) If the inflammation is stubborn, try painting with silver nitrate solution one per cent once a week.

(5) It should be remembered that a refractive error or a mild scaly blepharitis may be keeping up a chronic conjunctivitis.

Irritable Eyes.

A patient sometimes complains of general discomfort in the eyes, which he says feel "gritty," irritable and burning, especially after hard exercise, a dusty game, motoring, reading, etc., and yet there is little to be seen and no refractive error. The cause is often a slight conjunctival irritation, and he will benefit by the use of the eye-baths and drops given under "Chronic Conjunctivitis" above.

He will sometimes prefer a plain eye drop of:—

Zinc sulphate	..	..	½ gr.
Distilled water to	..	..	1 oz.

or a boric and zinc lotion as follows :—

Boric acid ..	..	..	8 gr.
Zinc sulphate	..	..	½ ,,
Water to ..	..	..	1 fl. oz.

General Notes on Eye Medicaments.

(1) *Zinc* should not be used in an eye in the presence of a corneal ulcer. It is irritating.

(2) *Yellow oxide of mercury ointment* (golden eye ointment) should never be used in an acute eye lesion. It is an irritant and should only be used when required as such, for example, to stimulate certain varieties of ulcers. Its use corresponds to the use of red lotion in general surgery and should be very limited.

(3) *Solid Cocaine.*—For the removal of a foreign body or the examination of a painful eye, if no cocaine hydrochloride solution is immediately available it will be found satisfactory to place a few crystals of the solid drug in the lower conjunctival fornix by means of the damp end of a match.

Cocaine should be used as little as possible, as it has a deleterious effect on corneal epithelium.

EYE INJURIES.

Corneal Injuries.

Superficial corneal abrasions, even if extensive, heal rapidly, unless they are infected. An extensive area of epithelium removed (as shown by staining with fluorescein) may be regenerated in forty-eight hours.

Treatment consists in protection of the growing epithelium by the closed lid, a light pad and bandage being used for this purpose. The eye should be opened and irrigated with a bland fluid twice a day while healing is taking place.

Contusions of the Eye.

The treatment of an eye concussion or contusion is simply rest, cold compresses, and possibly atropin. The vision of the eye should be taken

as soon as possible and recorded. The pupil should be dilated and the fundus examined for vitreous or retinal hæmorrhages or tears. Small quantities of blood in the anterior chamber are rapidly absorbed. The prognosis should be guarded, as, even if there has been no apparent damage, the passage of time may reveal injury, for example, retinal concussion, macular changes, or a slowly forming traumatic cataract due to lens capsule damage.

Corneal Foreign Bodies.

If a foreign body is embedded in the corneal substance, such as a piece of grit or a metal "spark," the eye should be anæsthetized (two drops of a four per cent cocaine hydrochloride solution repeated three times at two-minute intervals, the eye being gently closed meanwhile) and under good illumination (electric torch) and with magnification, if available, the particle boldly levered or picked out with a sharp needle.

Less damage is done in this way than by ineffectual scraping with a spud. The cornea is one millimetre thick and the danger of perforation negligible, unless the particle is deeply embedded.

After a metal particle is removed the red "rust ring" should be scraped away, or the eye will remain injected for some days while this separates.

Before and after removal irrigate the eye with a bland fluid and leave a drop of sterile liquid paraffin in the conjunctival sac. A light pad and bandage are applied and the eye irrigated twice a day until the wound is healed, which it normally is in forty-eight hours.

Penetrating Injuries of the Eye.

In any case in which even the smallest penetrating injury has occurred to the eye, even if the eye seems to quieten down rapidly afterwards, the patient should be brought under the observation of someone with special experience within ten days. The decision as to the risk of sympathetic ophthalmia in certain cases is extremely difficult.

Diseases of the Cornea.

Corneal Ulcer.

Intact corneal epithelium is resistant to infection by almost all organisms except the gonococcus. If the conjunctival sac contains disease-producing organisms, a local corneal injury or abrasion will lay the cornea open to infection, leading to the localized necrosis of the anterior layers of the cornea which constitutes the early corneal ulcer. Of these organisms, pneumococci and streptococci are the most dangerous. An infected lachrymal sac is a common cause of the presence of such organisms in the conjunctival sac and is always a potential source of danger to the eye. The importance of the corneal ulcer lies in the fact that it leaves a permanent opacity (nebula or leucoma), and if situated within the pupillary area impairs visual acuity. In the severe forms of ulceration there is the danger of perforation

into the anterior chamber, iris prolapse, anterior synechiæ and panophthalmitis leading to the loss of the eye.

A hypopyon ulcer is a severe form of corneal ulceration (usually pneumococcal in origin) which, by the absorption of toxins in the anterior chamber, irritates the iris and ciliary body, causing an outpouring of leucocytes, which sediment in a crescent at the bottom of the anterior chamber. This pus, in unperforated ulcers, is sterile and is absorbed readily if the ulcer is energetically treated and toxin-formation stopped.

The importance of examination of the cornea in cases of acute conjunctivitis, especially in children, has already been mentioned. The value of fluorescein in detecting an early loss of corneal epithelium has been stressed. A large and very obvious corneal ulcer, however, the crater of which is filled by epithelial debris, may stain feebly or not at all.

Treatment of the Corneal Ulcer.

(1) Irrigate the eye with a considerable quantity of lotion three, or more, times a day. Lotions and their method of application have already been discussed under "Treatment of Conjunctivitis."

(2) Put the eye at rest by the use of a drop of 1 per cent atropin sulphate solution twice a day.

(3) Prevent sticking of the lid margins by a trace of bland ointment smeared along their edges.

(4) Protect the ulcer by the closed lid secured by a loose pad and bandage. For these cases a single strip of three-inch bandage passed obliquely over the eye pad, below one ear and over the opposite temple, is sufficient. If applied damp, such a bandage moulds to the shape of the head when drying and so retains its position better.

Heat.—It is a moot point whether fomentations or hot bathing do good in these cases. In my opinion they do more harm than good, producing a sodden effect and increasing the risk of further damage.

Silver Painting.—Neither copper nor zinc must be used in the presence of a corneal ulcer, but silver nitrate is harmless. A thorough painting of the lids with silver nitrate, in the manner already described under "Treatment of Acute Conjunctivitis," if carried out once a day for one or two days in the early stages of the disease is, in my opinion, of great value in controlling the disease, especially in cases accompanied by a purulent conjunctivitis.

Scraping and Carbolizing a Corneal Ulcer.

In deep or spreading ulcers, especially with hypopyon, and in those covered with a thick protective layer of epithelial debris, scraping and carbolizing the ulcer is most effective. With a good light this is easy to do, especially if magnification is used. An eye spud or gouge or the slightly blunted point of a surgical needle is used. The eye is anæsthetized with cocaine and the ulcer thoroughly scraped out, especially at the edges. Reasonably forcible pressure is used in carrying this out. The base of the

ulcer is dried with the right-angled edge of stiff, sterile blotting paper. Pure carbolic acid on the end of a pointed match is then rubbed in, especially round the advancing edge. The excess of acid is mopped up with the blotting paper, and sterile bland ointment (or atropin ointment if available) is applied to absorb the remaining carbolic acid. The effect is often excellent.

Diseases of the Iris and Ciliary Body.

Acute Iridocyclitis.

An acute inflammation (which may be slight or severe) of the iris and ciliary body, which are richly supplied with sensory nerves, produces a diffuse, neuralgic aching pain in and around the eye, extending to the supra-orbital region and the temple. This is unlike the localized pain and gritty sensation of a conjunctivitis.

A mild conjunctival injection is common, but there is a marked circumcorneal "ciliary" injection, absent in a pure conjunctivitis. The discharge from the conjunctival sac is a profuse reflex watery secretion, not the muco-purulent discharge of the pure conjunctival inflammation. Photophobia is usually a marked symptom.

There is more or less dimness of vision due to the haziness of the aqueous.

As a result of the internal inflammation of these vascular and sensitive structures, an eye suffering from an acute iridocyclitis shows contraction of the pupil and often irregularity of the pupillary margin of the iris, sluggish response to light, and a blurred "muddy" iris pattern. The aqueous is cloudy from its albuminous and cellular content. (The method of demonstrating this is mentioned in the paragraph on the "Electric Ophthalmoscope.")

The combination of a muddy iris and a hazy aqueous with dimness of vision must not be mistaken for a cloudy cornea. The cellular exudate in the aqueous tends to clump on the portions of the posterior endothelium of the cornea already damaged by toxins, producing the small grey spots of keratic precipitates or keratitis punctata characteristic of the disease. These may be so tiny as to require high magnification for their discovery, or so large as to be easily visible to the naked eye. They indicate involvement of the ciliary body more than that of the iris.

The normal iris, during its constant movements, slides smoothly over the anterior capsule of the lens on which it rests, but when inflamed sticky exudate gums its margins down to the capsule (posterior synechia). These exudates, if allowed to organize, may become too strong to be broken down.

The slow and irregular dilatation of an inflamed iris after the instillation of homatropin and the presence of these posterior synechiæ is diagnostic of the disease.

The error of mistaking a case of glaucoma for an iridocyclitis is serious, as an acutely glaucomatous eye may rapidly become permanently blind, and the treatment of the two conditions is diametrically opposed.

Dilatation of the iris for purposes of diagnosis, so useful in both conditions, must never be carried out by means of atropin, but by homatropin, which can almost immediately be controlled by the repeated instillation of eserine. The differential diagnosis between the two conditions will not be discussed here.

Treatment of Acute Iridocyclitis.

(1) The treatment of the underlying cause of the disease. Syphilis (in its secondary stage) and gonorrhœa are said to account for nearly fifty per cent of the cases. Septic foci in teeth, nasal sinuses and intestine are held to account for others. Tuberculosis and, in the tropics, bacillary dysentery must also be remembered. Excluding syphilis and gonorrhœa, prolonged and detailed search for the source of the inflammation will often result in entirely negative findings.

(2) Dilatation of the pupil by the instillation of one per cent atropin sulphate solution or by one per cent atropin ointment. This, which should be done four-hourly until dilatation is established, and then twice or once a day, keeps the iris and ciliary body at rest and pulls the iris away from the lens capsule, so preventing the formation of posterior synechiæ and breaking down the weaker of those already formed.

A minimal quantity should be used at each instillation, or the risk of establishing an atropin irritation of the skin of the lids and cheeks is increased. If this extremely annoying complication occurs hyoscine should be substituted for atropin. The formula for this is given later under "Prescriptions." The atropin should be continued for a fortnight after apparent recovery from the disease.

(3) Hot Applications.—These are very comforting to the patient, diminish the pain and induce hyperæmia. It is in the treatment of these deep inflammations of the eye that hot bathing or hot fomentations are of most value. Ordinary hot fomentations are not very satisfactory as they cool rapidly. As a substitute, the patient may be made to lie with the eye resting on a hot-water bottle, from which it is separated by a layer of damp or dry cotton-wool of suitable thickness. Hot bathing is carried out in the following way: A thick pad of cotton-wool is tied to a spatulate piece of wood about twelve inches long; a wooden spoon of the variety used for stirring jam does particularly well. This is dipped in a basin of very hot water, the excess of water squeezed out against the side of the basin, the temperature tested against the back of the hand and the hot moist pad applied over the closed lids of the inflamed eye. As the pad cools it is dipped into the basin again and reapplied, the temperature of the water in the basin being kept up by the addition of more boiling water. This bathing should be carried out for twenty minutes three times a day. To retain the heat the eye is afterwards covered by a *large* pad of cotton-wool passing back almost to the ear.

(4) Bland irrigation of the eye should be used as required to keep the conjunctival sac free of discharge.

(5) Smoked glasses or a shade may be worn as desired.

(6) The bowels should be kept freely open during the whole course of the disease.

Note.—In severe cases, especially when it is found difficult to dilate the pupil with atropin, two leeches may be applied a short distance outside the external canthus.

Signs of Improvement in the Disease.

(1) Diminution of injection and pain.

(2) Iris dilating well under atropin.

3) Aqueous containing less albuminous exudate.

Diseases of the Lachrymal Apparatus.

Congenital Imperforate Naso-lachrymal Duct.

A dacryocystitis may occur in the new-born due to imperfect canalization of the epithelial cord in which the nasal duct is formed. The mother usually brings the baby when two or three months old and says that from birth one eye has watered a little and repeatedly gathers a little bead of yellow matter at the inner angle, while the other eye is clean and normal.

Pressure over the lachrymal sac produces regurgitation from the punctum.

Treatment.—If a simple eye-wash and frequent careful expression of the contents of the lachrymal sac over a period of a fortnight (this can be done by the mother herself) fail to relieve the condition, a probe must be passed down the nasal duct. This should be done by one with special experience, and one probing carefully done almost invariably results in cure.

If the condition is left untreated there is always the danger that a minor corneal injury to the eye affected may become infected from the contents of the obstructed duct, and may result in a severe corneal ulceration.

A chronic dacryocystitis in the adult is equally a potential source of danger to the eye but almost always requires excision of the lachrymal sac for its cure.

To express the contents of the lachrymal sac, press firmly with a slight massaging movement over a circular area of five millimetres radius, the centre of the circle being three millimetres directly internal to the inner canthus of the eye.

Miscellaneous.

The following are rather disconnected jottings on points of general interest:—

Testing of Visual Acuity.

Distant visual acuity is recorded by a fraction, the numerator of which represents the distance from the patient to the test type. For Army work this is a constant of six metres, or twenty feet. The various denominators, which alone are marked above each line of the test type chart, represent the distance at which a person with normal sight should be able to read that line. For example, if a patient seated at six metres reads the top line

only, which line should normally be read at sixty metres, his vision is recorded as $\frac{6}{60}$.

$\frac{6}{6}$ is relatively poor "normal" vision and admits of the presence of quite a high refractory error under certain conditions. With good chart illumination a really normal-sighted person will usually read $\frac{6}{5}$ easily, $\frac{6}{4}$ partly, and on very rare occasions even $\frac{6}{3}$ with each eye separately.

Army test types have no line beyond $\frac{6}{6}$, and to obtain the equivalent of $\frac{6}{3}$ it would be necessary to move the chart to a distance of 12 metres from the patient while he reads the $\frac{6}{6}$ line.

The instructions in the Regulations for the Medical Services of the Army, that "Each eye will be examined separately and the lids must be kept wide open during the test," are important.

A purely short-sighted person, whose unaided vision is $\frac{6}{60}$, can, if allowed, to half-close the eyelids, read $\frac{6}{18}$. If, experimentally, the same person is allowed to examine the test-card through a pin-hole in a visiting card, he can read $\frac{6}{6}$.

The mere fact that a person can read $\frac{6}{4}$ (and this is very acute vision) does not prove that he has "normal" eyes. A purely long-sighted (hypermetropic) person may read $\frac{6}{4}$ and yet have two dioptres or more of hypermetropia, and consequently strain on sustained accommodation.

It is practically impossible to tell in a medical inspection room whether the ocular complaints of a soldier are genuine or not. Detailed examination is required. For example, a man may not only have perfect vision with each eye separately but also no error of refraction of either eye and yet, owing to a defect of muscle balance, may suffer considerably from eyestrain.

The Use of Glare Glasses in the Tropics.

Glare glasses should be used only if found to be definitely comforting, and not as a habit to "save the eyes." If used they should be of good quality and not the bazaar-made "coloured window-glass" variety.

For India, the most satisfactory ones are either Crookes' B1 (light smoke) or Crookes' B2 (dark smoke). The choice should be left entirely to the patient and should be made out of doors in strong sunlight.

Toric glasses, i.e., the segment of a hollow sphere, are often more suitable than the flat type for use as glare glasses, as they can be made to fit more closely to the eyebrow and cheek, thus cutting off the maximum of light without rubbing on the eyelashes. Side flaps are rarely necessary.

If required, the patient's own spectacle correction may be ground on to his glare glasses.

For hard tropical use the spectacle frame should be made of metal. Such a frame is often "camouflaged" with a layer of imitation shell over the metal.

Eye Headache.

A fairly severe headache of relatively recent origin is rarely due to eye trouble alone. Eye-strain, somewhat surprisingly, sometimes produces a

morning headache which wears off a little after breakfast and then comes on again.

A frontal or occipital headache is more likely to be due to eye-strain than a vertex headache.

Discomfort after near work, first observed only when working in artificial light, and relieved by increasing the reading distance, is one of the first signs of presbyopia.

A considerable number of cases of frontal sinus catarrh come for examination of the eyes. These usually give a history of a recent and fairly acute onset, perhaps following on a cold in the head, with gradually increasing severe frontal neuralgia over one eye only, the pain being unaffected by the use of the eyes.

The pain comes on during the heat of the day, reaching its maximum in the early afternoon, and dies away in the evening, only to recur late next morning. The frontal sinus on the affected side is tender to pressure from under the roof of the orbit.

Muscæ Volitantes.

These black specks floating before the eyes are seen by almost all normal persons under certain conditions. They are due to opacities of various kinds, mostly in the vitreous, throwing shadows on the retina, these being projected as dark spots of various shapes in the field of vision. They are naturally best seen against a brightly illuminated background, such as a white wall or a piece of white paper. If there is no sign or symptom of disease of the eye, muscæ are best ignored, as they are often only visible when attention is specially drawn to them.

In this connection, an easy and rather interesting experiment is the following :—

A sheet of plain white, thin paper, the larger in size the better, is held in the left hand just in front of a powerful electric light bulb, while a pin-hole in a visiting card held in the right hand is moved, at the rate of three or four times a second, in a circular direction before and very close to the right pupil. Meanwhile, the left eye is kept closed while the right eye looks steadily at the centre of the foolscap sheet through the pin-hole. An accurate and very detailed plan of the retinal circulation near the macula is projected on the sheet which acts as a screen, and it may be noted incidentally how small is the avascular area at the macula.

This test depends on the fact that there is a small but definite interval between the blood-vessel layer on the retina and the perceptive layer—the rods and cones.

The perceptive layer of the retina is stimulated by the shadows from the vessel layer. These shadows are in rapid movement, due to the rapid parallactic movements of the beam of light entering the pupil through the hole in the visiting card.

The vessels in this case are acting as opacities in the media and their outline is projected on to the screen.

The experiment can be made more interesting by increasing the size of the screen (which must always be powerfully illuminated) and by standing at various distances away from it.

If the pin-hole is oscillated horizontally only, in front of the pupil, then naturally only the shadows of the vertical retinal vessels become visible and vice versa.

The Master Eye.

It is sometimes of value to discover which of the two eyes is the master eye.

The examiner and patient face each other at a distance of about six feet. The examiner covers one of his own eyes, the patient keeping both eyes open. The patient is directed to raise his hand and point with the tip of the forefinger at the examiner's open eye. The examiner's eye, the patient's forefinger, and the patient's master eye will then be found to be in line.

The master eye is used in preference to the other when aiming a shot-gun, using a single eye-piece microscope, etc. The right is usually the master eye. As a matter of interest, the majority of dental officers I have examined have been left master-eyed, whether from the nature of their training and work I am unable to say.

Malingering.

Malingerers may be divided into three classes :—

(1) Those who exaggerate the symptoms of a real disease. Care is required here, as these men often do so merely to impress the examiner and have no intention of really malingering.

(2) Those who produce a disease. The disease produced is almost always self-inflicted conjunctivitis. This has already been dealt with elsewhere.

(3) Those who pretend to have a disease they have not got. This class almost invariably simulates an amblyopia. It would be of no value to discuss in detail here the rather fascinating art of the detection of the clever eye malingerer.

The crude case can be unmasked by a few simple tests, but the clever man requires for his exposure, patience, gentleness and some skill. I much prefer to receive such cases when they themselves are unsuspicious and unwarned of the medical officer's suspicions. A very full examination is required anyway before they can be classed, even in one's own mind, as malingerers, and I find it easiest to "catch them out with kindness" in the routine course of this examination.

It is more difficult to carry out this procedure in a suspicious and antagonistic patient.

In my experience, malingering is much more common in England than in India, where it is relatively rare.

A common case is that of the recruit in about his third month at the depot; but no period of service is immune, and it is disconcerting to find an obviously excellent type of N.C.O. definitely (and subsequently self-

confessedly) malingering, until it is discovered that quite laudable domestic reasons provide the explanation.

Prescriptions.

The following prescriptions may be of use (eye lamellæ obtained from the ordinary dispensary may be very old and their action doubtful, or they may be quite inactive) :—

Atropin Drops.

Atropin sulphate	.. ..	4 gr.
Sterilized distilled water to	..	1 fl. oz.

Can be sterilized. These drops should be used for treatment only, never for diagnostic dilatation. The effect of atropin is uncontrollable by any drug and lasts for ten days. Not to be used especially if there is any suspicion of glaucoma.

Cocaine Drops.

Cocaine hydrochloride	..	8 gr. or 16 ,,
Sterilized distilled water to	..	1 fl. oz.

The weaker, two per cent, solution is sufficient for anæsthetic purposes in most cases. Used to anæsthetize cornea and conjunctiva. For minor operative work, such as injecting a lid preparatory to incising and curetting a meibomian cyst, two per cent novocain to which a trace of adrenalin has been added will be found the most useful.

Adrenalin and novocain can be sterilized separately but not together, or the novocain is destroyed. They will keep together indefinitely.

Homatropine Drops.

Homatropine hydrobromide	..	8 gr.
Cocaine hydrochloride	..	8 ,,
Sterilized distilled water to	..	1 fl. oz.

For diagnostic and ophthalmoscopic dilatation. Homatropine is not sterilizable, nor is any solution containing it. Homatropine hydrobromide costs fourpence per grain. One drop of this solution placed in an eye every ten minutes should produce full diagnostic dilatation in forty minutes. The younger the patient the quicker is the effect produced. In Indians the dilatation is often very slow. The eye should return to normal in twenty-four or thirty-six hours.

Hyoscine Drops.

Hyoscine hydrobromide	..	2 gr.
Sterilized distilled water to	..	1 fl. oz.

This solution is sterilizable. It replaces atropin when this drug has produced an atropin irritation.

Eserine Drops. (Synonym—Physostigmine drops.)

Physostigmine sulphate	..	2 gr.
Sterilized distilled water to	..	1 fl. oz.

Neither eserine nor any solution containing it is sterilizable. This solution is used to cause contraction of the pupil, usually after the use of homatropine. Its use is rarely necessary for this purpose up to the age of 35 years. Always to be used if there is any suspicion of glaucoma.

Oily Eserine.

Eserine (base)	.. ..	4 gr.
Cocaine (base)	.. ..	8 ,,
Castor oil to ..	.. ..	1 fl. oz.

Dissolve the bases in a minimal quantity of chloroform. Add this to the oil and mix. Drive off the chloroform in a water bath till hardly any smell is left. This cannot be sterilized. Note that the oily solutions are made up with bases not salts. Oily eserine is more satisfactory than the watery solution for the purpose of contracting the pupil. The watery solution, unless repeated, may be rapidly washed out of the conjunctival sac by tears.

Zinc Drops.

Zinc sulphate	.. ..	1 gr.
Sterilized distilled water to	..	1 fl. oz.

Requires a trace of sulphuric acid to make a clear solution. It is better to use it without the acid.

Silver Nitrate Solution.

Silver nitrate	.. ..	8 gr.
Distilled water to	.. ..	1 fl. oz.

Used for lid painting in acute conjunctivitis, etc. To be kept in the dark and made up reasonably often.

Fluorescein Solution.

Fluorescein ..	.. ..	8 gr.
Sodium bicarbonate	.. ..	12 ,,
Distilled water to	.. ..	1 fl. oz.

Used to stain the cornea suspected of corneal abrasion, ulcer, or other injury, which may have removed the corneal epithelium. Fluorescein is difficult to make up and is best bought ready made. It is very cheap.

Protargol.

Protargol ..	.. ..	120 gr.
Distilled water to	.. ..	1 fl. oz.

Argyrol can be used the same strength. To make up, sprinkle the powder on top of the cold water and allow to dissolve slowly. These solutions, much used as antiseptic eye drops, are of doubtful utility.

Boric and Zinc Lotion.

Boric acid ..	.. ..	8 gr.
Zinc sulphate	.. ..	½ ,,
Water to ..	.. ..	1 fl. oz.

A good standard eye lotion for use in an eye-bath.

Atropin Ointment.

Atropin (base)	.. ..	4 gr.
Boric acid (in powder)	..	60 ,,
Soft paraffin to	.. ..	1 oz.

Heat to dissolve the base in the paraffin, add the acid and stir very thoroughly till cold. Note that the base is used as the salt is insoluble in fats. For long-continued use, atropin ointment is to be preferred to atropin drops. The *minimal* quantity to produce the required effect should be used, otherwise there is a risk of producing an atropin irritation of the skin.

Note.—The quantities given above are those required to make up one ounce. These can be varied as necessary; for example, boric and zinc lotion will probably be required by the pint, silver nitrate solution by the drachm.

THE DOCTOR'S WAR.

By D.A.D.M.S.

(*Continued from p.* 282.)

In the course of one's affairs visits to Armentières, Chapelle d'Armentières and Houplines were frequent. Though the Germans were very close to Armentières they were very patient with the town. At times they got annoyed at something and pounded it severely with shell fire. At such times it was strange to notice that the inhabitants repaired to their caves *before* the shelling commenced. Perhaps not so strange when one knows that electric power from Lille, occupied by our friends the enemy, continued for some weeks to be supplied to Armentières. The A.P.M. was a man of intense energy and restlessness. He scoured the town nightly looking for men out of billets without passes. As Armentières was almost fully occupied by its civic population in the year of grace 1914, so also was it occupied by many ladies of easy virtue who carried on a highly lucrative business. Our business was to keep the men free of disease, so that the ladies' interests and ours did not coincide. Our dear Allies were not terribly helpful. They looked upon us as fussy people, and said "C'est la Guerre." I took council with a French liaison officer and asked him what could be done. He said it was all quite simple. "Find out," he said, "where such ladies live and write above the door, 'Here lives a syphilis!'" The A.P.M. worked hard. He would visit a quiet looking estaminet with his police. Soldiers sat about drinking wine or beer. If it was after hours their passes were examined. Suddenly A.P.M. and staff would rise and dash up the stairs. At all bedroom doors they would hammer and demand admittance in the name of the Law. Frightened occupants would appear in various stages of undress and show their passes. If all correct the Military Police would gracefully apologize for the disturbance and withdraw. Should the occupant of a room be a soldier or N.C.O. away from his billet without leave he was marched off to the clink. One Scottish serjeant we unearthed made a strange request. "I beg your pardon, sir," he said. "May I go back for a minute and get my five shillings? I don't like wasting good money." I suppose the morals of all this were quite wrong, and I am quite sure the French proprietors of the estaminets thought the A.P.M. was entirely and completely mad. And all the time the great spy hunt raged. Of course, even now the old "light in the window signal" was the commonest. Suspicion fell upon a farm near Croix du Bac, and our indefatigable Provost Marshal staged a night attack to catch the miscreants red-handed, or red-lighted, so to speak. The farm was surrounded by the M.P. detachment at dusk. The A.P.M. and his pet French interpreter sleuth took cover behind the hedge, and the weary watch was set. Long hours they watched,

the rain fell and the November winds of Flanders blew hard and cold. Near dawn something happened. Lights appeared in the lower windows of the house, then window by window showed a light and darkened again. They rose from their cramped positions, a whistle shrilled clear, and a concerted rush was made for the door. In they burst, holding their pistols ready for instant action. The big hall kitchen was deserted, but sounds of movements could be heard in the rooms overhead. The French sleuth placed his finger to his lip to signal for silence, then holding his drawn revolver in his hand started to creep up the dark stairs. But somebody was coming to meet him! Madame appeared on the stairs above, a candle shaking in her hand, and a terror-stricken look on her face. At once the interpreter dashed up to meet her, and a flood of rapid excited French broke out, talking, gesticulating, they passed up the stairs and entered a room. Silence fell on the group below. Presently the door above opened and the interpreter appeared. From the open door came a thin, little wailing cry. As he descended the stairs the Frenchman stopped, raised his eyes to heaven, shrugged his shoulders high, threw his hands out in a dramatic gesture and spoke: "The daughter of Madame she have a baby, the women of the house move about with candles, and so the lights."

On December 2 His Majesty the King visited Divisional Headquarters. All members of the staff were drawn up in two lines in the little garden of the villa to receive him. The car arrived and pulled up at the gate. The driver was a slim youth wearing the loose khaki plus-fours of the Brigade of Guards, the Prince of Wales. The King got out, was met by the G.O.C. and conducted up the path to the waiting line of staff officers. The dear old General introduced us one by one, but being at all times a little absent-minded he suddenly found himself opposite an officer he did not know! This was a senior Major R.A.M.C., who was deputizing for the A.D.M.S. absent on leave. With a little hesitation the G.O.C. said, "This is—ah—Major Smith," and the incident passed. The so-called Major Smith was extremely put out, and had a serious talk with me afterwards. He pointed out that should His Majesty be pleased to convey any little sign of his pleasure in meeting us, such as the M.V.O. or any little thing like that, it would be very awkward if the names were not correct. But nothing happened, though a sportive member of the Staff had chalked M.V.O.'s on the breasts of the various plaster casts of famous Frenchmen that decorated the mantle-piece of the Staff room. It was rumoured afterwards that the King took a special interest in the great map of our line spread out upon the table. Turning to the G.O.C. he said, "Just put your finger on the spot where we now are." Though the General well knew our front line he was unable, in a moment, to find Croix du Bac on the map!

Several times during December the enemy turned on their guns and heavily shelled Armentières. The asylum on the outskirts of the town was used as a rest billet for infantry battalions out of the line. So the gunners elected to plant a couple of six-inch guns just outside the asylum grounds.

When the six-inchers got busy the Boche started in to locate them, and, of course, the poor old asylum got knocked about. Then words passed between gunners and infantry. "Why," said the infantry, "do you draw fire on us by planting your blasted guns right beside us?" "But," said the gunners, "our guns have nothing to do with it. If you blasted foot-sloggers *will* stick your heads out of the top-storey windows of course the Boche will shell you." It was a fact that the top stories of the asylum could be easily seen from the German lines, and actual orders existed that "Troops occupying the asylum should not make a practice of looking out of the windows."

One's life at this period of the war consisted in a continual round of business-like affairs. Visiting trenches to discuss sanitary matters with O.C.'s and M.O.'s, endless troubles and "strafes" about the prevention of "trench-foot," the difficulties in keeping up a steady working system of de-lousing, washing and re-clothing men at the bath house, fighting for the anti-typhoid inoculation of all drafts arriving from England not inoculated, and this was a common occurrence. Necessarily the brigade commanders objected to men being taken out of the line to be played about with by those darned doctors, but on the whole I think we won. When we consider that an army of under 400,000 during the South African war lost 8,000 men *dead* of typhoid fever, and that the Great War with its millions produced only 8,000 cases of typhoid with a death roll of under 300, was it not work well done? If any man in the world deserved a nation's gratitude it was the late Sir William Leishman, Director of Pathology to the Army during the War, and after the War Director-General of Army Medical Services. Sir Almroth Wright introduced anti-typhoid inoculation into the British Army as long ago as the days of the South African War, but at that time the opposition was so acute that it had to be dropped. But Sir William Leishman carried on the work, and when the Great War commenced it was a routine principle that all troops proceeding to any front should be protected by inoculation. No doubt improved sanitation taught to officers and men from the Royal Army Medical College at Millbank, and the School of Hygiene Aldershot, also helped; but surrounded as our army was by peoples on all our fronts who took little heed of modern sanitary ideas, and in all countries, even in France, typhoid fever was looked upon as a common, everyday, to-be-expected disease, the chances of an epidemic starting, that would make the great Plague of London look like a common cold, were immense. But it never did, and our sheet anchor was inoculation. Again and again the turmoil of heavy fighting broke up the system of sanitary control. Often in France the surrounding farms went through waves of typhoid epidemics, two or three cases in one house was common enough, and the peasant Frenchman nurses his own sick—or buries them. No hospitals for him. Victorious generals returning from the War were given peerages and large grants of money. I suppose they earned them, but Sir William Leishman who saved hundreds of thousands of lives got a K.C.B.

Christmas Day was cold, bright and frosty. By tacit agreement there was no firing, and at several points the troops left their trenches and fraternized with the enemy. Accounts stated that the men exchanged cigarettes for cigars, bully-beef for German sausage, and were quite friendly together. Officers met and chatted with German officers. I was told that the Germans talked about the jolly times they had at Lille when out at rest billets. Plenty of champagne, dancing, comfortable houses to live in, nice French girls to play about with, and so on. One English subaltern could not stick this and broke in with : "Yes, awfully jolly for you, of course, but how you will miss it all when we take over Lille from you in the very near future."

Stern orders came flashing over the wire from General Headquarters that violent measures would be taken if any further attempts at peace were inaugurated by officers or soldiers; Germans attempting to come over and be friendly were to be fired upon at once, and so the poor little Christmas truce died out with the roar of guns and the rattle of rifle fire. What would have happened on that December 25, 1914, if both sides had refused to fight against each other any more? Would it have ended in Red Revolution on all sides? No, you cannot smash the machine of war in a moment ; the long built up organization must go on when once started, until it runs down. And so it was; it went on until the German machine slowed down, faltered, and ceased to function.

The daily routine is sharply interrupted by an entry : "Called in by A.P.M. to attend a confinement case, no French doctor available." The A.P.M. provides all the relief from monotony ! I suppose every war that ever was can be epitomized in the saying : "Months of boredom, punctuated by moments of intense fear." I accompanied the G.O.C. on his inspection of the cottages used as billets for the troops in the Chapelle d'Armentières section. We arrived in full panoply of staff cars, and the solemn inspection commenced. The enemy must have sensed the presence of the G.O.C. for they at once started to shell the wretched place. The General was calm and collected. Slowly he passed from house to house, had us all round him in the street while he asked questions about cooking, keeping the food hot, blankets, drinking water, endless questions! And all the time shells whooped and screamed, burst with loud bangs, sent red-hot splinters sizzling about, and severely frayed the nerves of the General Staff. But still the General moved sedately along, at length reached his car, and stopped again to chat once more. Reluctantly he tore himself away, and we were free to tumble into our cars and make after him.

About this time brigades were so tired of the system of reliefs in trenches, one brigade in the resting area, and the other three in the line, that they asked for and got their own system of all four brigades in, and each brigade ran their own reliefs. The troops out of the line were billeted in Armentières which had become to them a home from home. Four or five men would occupy one room in a small house, a workman's house, little

rooms, but clean and comfortable in comparison with trench life. These men returned again and again to the same house, provided they *did* return, and a very friendly spirit grew up between the host and his lodgers. Madame took over the rations and fed her own family and her lodgers out of them, and fed them well. Succulent soups, stews, ragoûts, etc., she turned out, and the men were very content. They helped in the household work, looked after the children, and the French people loved them. And who would not? Those tireless, cheery, patient, plucky fellows, the very salt of the earth. I have known the British soldier in peace and war, and I take off my hat to him every time. And yet in January, 1915, they were not my old friends of August, 1914; the ranks of battalions had filled and emptied, and filled again many times even in those short months. But I saw no change in the soldiers. They seemed to me the same type, they made the same jokes, and they sang the same songs, and they behaved in the same cheery way in all adversities. I remember visiting billets at Bois Grenier on a foul cold day, to find the Argyll and Sutherlands walking about contentedly in bare legs. They had been so bogged and stuck in the trenches, that numbers of them emerged minus shoes and stockings.

I remember a private brought into a Dressing Station with both hands blown off at the wrists. He had been fighting—save the mark!—with jam-tin bombs, just old tins filled with high explosive and fitted with a few inches of fuse. The men were told to: (1) take out a match-box and light the fuse; (2) count five slowly; (3) throw the home-made bomb. Just try and visualize doing this during an enemy attack! Consequently accidents would happen. But that poor fellow, hopelessly maimed for life and in great pain, had no word of complaint or bitterness against anyone. Not though the enemy plastered him with high explosive bombs that *were* bombs, rifle grenades, trench mortar "flying pigs," and every sort of well-thought-out way of killing him off that a well-prepared army could supply. Not though his own guns were down to three shells a gun a day, his machine guns two per battalion, his offensive weapon was one rifle and one bayonet, and that was good enough for him. I remember seeing a home-made trench mortar made from a bit of old iron piping in some ingenious way. The subaltern who manipulated this exceedingly dangerous weapon, lit the inevitable fuse, and all concerned bolted round the next traverse to wait for the detonating crash that meant the thing had blown itself up, or that it had managed to lob a shell of sorts in the direction where the German trenches were sited. And there were no reinforcements worth talking about. We just hung on in some sort of way. I can see staff officers standing outside their office doors to watch a single company of reinforcements marching up the village street, and damned glad to see them too. I can recall the jokes about "Kitchener's Army." "The war will be over when Kitchener's Army and the *other* neutrals come in." A subtle jest that!

The winter was severe and "trench feet" were a source of great trouble.

A man's feet would swell and be cold and blue and devoid of feeling in one night's exposure. As a soldier, he suddenly became a useless burden and must be got rid of. Many were the devices to prevent this troublesome complaint. Mineral jelly, whale oil, cod-liver oil, dodges for drying socks, loose puttees, all sorts of ideas. From General Headquarters came one priceless effort. "It is recommended," it read, "that men exposed to adverse climatic conditions in the trenches should keep up the circulation in their feet and legs by briskly walking about, and if at the time a brisk walk is not possible, the man should lie down on his back and wave his legs in the air!" This to be read by a bemused soldier standing in three feet of slimy mud and water!

To one's other duties were now added that of a sort of municipal sanitary inspector. As a division we were now responsible for the sanitation of Armentières. Though it still housed a considerable civil population, the municipal, sanitary, and health organization was practically non-existent. So one ranged up and down trying to keep the town clean and healthy. Although the weather was cold and miserable, the health of the troops was remarkably good, the divisional sick rate was as low as 1·7 per thousand, that is, less than two men in every thousand were sent away sick each day. Rather wonderful it was.

Our home life, in the ex-shop billet, became troubled, and for a strange reason. Madame, the mistress of home and shop combined, had returned. At first she was most apologetic at returning, established herself in a small shanty in the garden, and was most pleasant. Did she not point out the store of wine she had hidden away when she fled before the Boche invasion? Did she not press us to drink it up? Did she not, the next week, produce a very large bill for the vin ordinaire we had consumed at her special request? Did she not seize the opportunity when we were all out to turn our mess room once again into the shop? And when we got back to lunch we found the room full of ladies of Flanders trying on various habiliments, mostly consisting of incredibly ugly petticoats, blouses and hats. At such times madame completely ignored us, and went on with her business affairs as if we did not exist. We used to stand this for a few days, and then we would incite our ex-diplomat to go for madame and tell her this business must stop. She was being paid good rates for billeting so many officers, so many rooms, etc., and it was only just that we should have the use of the rooms to ourselves. Trade would cease, garments were packed away, and all would be peace *until* the next time madame could catch us all out of the house for the day. It was rather quaint to be away at a war all day and return to find our only home torn from us by the pursuits of commerce. But madame had another side to her character. She was very friendly with the mess servants. I often heard them conversing in madame's little shack in the garden. Though none of the servants talked any French and madame talked no English, the briskest of conversations would go on punctuated by bursts of hearty laughter. What they talked about heaven

knows, but there seemed no difficulty in understanding each other. I am afraid madame commenced very early to pick up English of the baser sort. The men played pranks on her at times. Once they bolted her out from her little domain, and I, from my bedroom window, heard this madame speaking: "Ouvrez, ouvrez, s'il vous plaît," and then very slowly: "Open the door you bloody fools!"

I was curious why the French peasant class were so stand-offish with the officer class, and so quick to make friends with the men. A Frenchman told me why. "It is," he said, "because they associate your officer class with the German officers. They don't think you a bit like the French officers, and they are rather afraid of you."

Another spy scare brought us some amusement. The village of Bois Grenier was a very unhealthy spot from the soldier's point of view, in that the Boche frequently shelled it. Yet many houses were intact, and though the inhabitants had more than once been evacuated, they managed somehow to get back again. It came to the ears of the A.P.M. that a young woman of prepossessing appearance was frequently seen moving about the village, and, on inquiry, it was discovered that she posed as a refugee from Lille returned to her native village. But the people left in the village said they had never seen her before, and that, in effect, she had suddenly arrived, and was keeping house for an English officer! More investigations proved that she certainly occupied a house, and that a veterinary officer was billeted in the same house. Dramatic as ever, the A.P.M. dashed up to the door of the house in his staff car, complete with interpreter sleuth and M.P.'s, at the hour of midnight. The house was dark and silent, but persistent knocking produced a light in an upper window, and from the open window appeared the head of an indignant veterinary officer demanding what the hell the row was about. Sternly told to descend and parley, he did so, and found himself confronted by the A.P.M. "You have a woman in this house, who is she?" The somewhat sobered vet. admitted that he had. "Who is she?" "How the blazes should I know?" answered the amorous officer. "I picked her up in Boulogne and got her up here to run this billet for me." "Has she permission to reside in the war area?" "No." "How do you know she isn't a spy?" "I don't know, all I know is she is a fine little girl and looks after me very well. Besides," he added proudly, "I can talk quite good French now."

But the romance was broken, the girl was told to dress, pack, and be ready to start at once with the A.P.M. So she did, entirely calm and collected, and back she was driven to Croix du Bac. Somewhat late it was when they arrived, and the only available spot at the moment to conduct the investigation was the A.P.M.'s own bedroom. The A.P.M. and the sleuth brought the girl along, and staged a sort of third degree—talk all night—inquiry. But the little lady was not having any such. The moment she entered and saw a perfectly good bed, she sat down on it, and proceeded to prepare herself for a good night's rest. "I am tired," she said, "you

have disturbed my night, and I now go to bed," which she promptly did, in the A.P.M.'s bed. Next morning the mess servants found a weary officer asleep in a chair over the dead ashes of the mess room fire. But when that gallant officer told his story at breakfast, it was received, I regret to state, in a spirit of ribaldry and unbelief. The little lady was removed that day to Corps Headquarters by the chastened A.P.M., but he heard a great deal about it for many days to come. History does not tell us the sequel. I hope the lady got off all right. Whatever her morals may have been she had plenty of pluck.

The month of January continued cold and wet, yet the sickness rate remained very low; the figure for January was 0·43 per cent, not half a man sick for each hundred in the division! Pretty remarkable, considering the conditions the men were living under.

A very important advance in medical administration took place on January 20. It was now laid down from General Headquarters that seven motor ambulances, one motor cycle for each of the four Field Ambulances, two workshop lorries and one car were allotted to the division. Five of the ambulances were to be kept at Advanced H.T. Depot, and kept mobile to meet emergency calls, and two, I think, to be kept at Divisional Headquarters and loaned out to field ambulances.

Care of the feet, to prevent frostbite, or trench feet, as it was now called, was a constant worry. It seems from the diary that we issued tons of whale oil and cod-liver oil. I know the former was very popular in the trenches for cooking purposes. I don't know if the latter was used as a general tonic as well as an unguent for the feet! Perhaps a few direct extracts from the diary will convey more of the daily situation than talking about what one was doing all the time. So here goes:—

"January 26, 1915. Visited Field Ambulances. Inspected London (T.) R.E. Company at Erquinghem. Thirty-one cases have been admitted to Bac St. Maur with scabies. All clothing has been steam disinfected. Arranged with O.C. sanitary section for fitting up two portable disinfectors at divisional bath house. Visited Petit Mortier. Issued eighty gallons of fish oil through re-filling point, and arranged to draw sixty gallons to-morrow. Inspected troops in billets at Asylum Armentières. Called for report from M.O. of Queen's Westminsters on incidence of scarlet fever in his battalion since leaving England. Met Town Major Armentières and O.C. Sanitary Section, and discussed sanitation." And in the margin—"Casualties—Officers 2, other ranks 70."

It makes queer reading! Might be the daily notes of a Medical Officer of Health in Kent if it were not for that little jarring note in the margin—casualties. But on the whole it makes rather remarkable reading. Listen to this: "No. 554 Cpl. Paine, No. 2 Section, Divisional Ammunition Column, at Meteren, diagnosed cerebrospinal fever. Advised M.O. and arranged to see him. No. 10189, Smith, B. Company, West Yorks, suspected enteric. Notified M.O. by wire and arranged to meet him.

No. 10431, Meredith, 1/K.S.L.I., diagnosed cerebrospinal fever. Arranged to meet M.O. This is the first appearance of C.S. fever in the division. Arranged for isolation of contacts, disinfection of clothing and blankets, and disinfection of billet. Notified O.C. Mobile Laboratory. Attended meeting of local Maires at Sanitary Section Office, as sanitation of outlying small towns is very bad and local French authorities do nothing! Visited D.L.I. to see M.O. about case of enteric. The D.A.Q.M.G. 3rd Corps came to us for information on system of evacuating sick and wounded." Certainly a mixed bag of affairs to be going on with a division in action.

At this period the Canadians arrived; a brigade was attached "for instruction," in other words, to learn the best way of killing off the enemy without getting killed yourself. We had some of the Divisional staff attached, and the Canadian A.P.M. lived in our mess. Our policeman, anxious for tips how to keep discipline amongst these wild colonial soldiery, asked the Canadian what their system was. "Wal," said he, "it's pretty simple. We just keep discipline with a club." But our P.M. told us later that though the Canadian rank and file were most amenable and well-behaved, they quite thoughtlessly did quaint things. On one of the night patrols in Armentières he came on a comparatively sober and serious Canadian soldier rolling a small barrel down the street. When asked to explain, he replied with great simplicity, "Wal, it's just a little barl of rum. I bought it, and I'm taking it along to the boys to have a jolly." He was very horrified when the P.M. confiscated the "barl." One Field Ambulance was shelled, all the windows in the building were smashed, but there were no casualties. Cook's tours were now on and we had visits from various staff officers, medical and otherwise, come from England to learn all about war as it should be carried on. We were now getting so settled that we took a nice house in Armentières, quite undamaged, and made it into an Officers' Convalescent Hospital, so that mild cases of illness, very slight wounds, tired and weary officers, could come there and lie in comparative comfort for a while. Personally, I thought this establishment in the Rue Sadi Carnot rather nonsense, the town was frequently shelled, and it was only a matter of time until the house itself would be smashed up. Also I could not see much benefit for the nerve-racked officers in a place exposed to shell fire. My view was correct. Later on the place was shelled out, and given up. On March 12 the North Staffords carried out an attack; I believe this was the first instance of a large-sized "raid." Five officers were wounded, one killed, or rather died of wounds, and twenty-five men lost. The attack was successful, but the Germans, as usual, retaliated with heavy shell fire and casualties on the next day rose to seventy-seven. Some trouble arose between the O.C. Field Ambulance and the O.C. Battalion over this little action. The recognized system that the regimental stretcher bearers bring back their own wounded to the regimental aid post where their own regimental doctor receives them, dresses them, and turns them over to the Field Ambulance, R.A.M.C.

bearers to carry them down the communication trenches to the advanced dressing station, broke down for some reason, the result being that R.A.M.C. bearers were asked to go right up to the consolidated front line bit of trench captured from the enemy, and to go out over the wire to bring in a dead man. They did what they were told to do, but the field ambulance M.O. in charge of the R.A.M.C. party complained that his men were asked to exceed their duties. However, the matter was settled between the Brigadier and the two commanding officers. The R.A.M.C. came out of it well, as they behaved gallantly, though, at the time, they thought, and rightly so, that they were being "put upon." I was very glad it was so, as nothing is worse for *morale* than any feeling of a want of confidence between the actual fighting man and those whose job it is to give him aid when he is wounded, and God knows he deserves all that can be done for him.

A Canadian Division was now coming in on our right, and there was a shift of a part of the line. I paid a visit to the A.D.M.S. Canadians, and found them involved in settling up their new line, positions of A.D.S.'s, etc. The A.D.M.S. was a fine acute type of man, and amused me much by his attitude to his own G.S.O.1 who came into the office seeking information. He asked the A.D.M.S. about arrangements for some part of the line not as yet quite clear. A.D.M.S. was evidently not himself quite clear about it, but he got out of it very neatly by asking his deputy "Who is the field ambulance commander responsible for that bit?" On being told it was Lieutenant-Colonel X., the A.D.M.S. turned impressively to his G.S.O. and said, "This is how I make it. Lieutenant-Colonel X. will clear casualties from the line you ask about. If he makes good, I leave it to him, but—" and he struck the table with his fist—"if he does *not* make good, *I* step in and take charge." Very impressive and imposing as the strong man in the right place.

The Director-General of Medical Services in France visited us to-day. Sir Arthur Sloggett was as spick and span as ever, full of good cheer, chatty with the men, and pleased everybody. He had a look at our Divisional Rest Station, and gave me a sort of jolly order: "Come to St. Omer, my boy, lunch with me and see the Convalescent Depot there, pick up some tips there, my boy." I went off next day and, rather awestruck, lunched modestly with the great medical chiefs. They were all very pleasant, very busy about this and that; how extraordinarily different it all seemed in this pleasant house in this pleasant sleepy old town. The silence from all unseemly noise of war, the pleasant chatter, the arrangements for the afternoon rides, the gentle bantering of each other at lunch. I came away with my spirits calmed and soothed.

Some anxieties were raised concerning the water supplies in the trenches. I see this note: "From personal observation of trench conditions, I do not think there is much chance of water-borne diseases being caused by contaminated water supplies. So far (eight months) we have

had no disease attributable to infected water." This was a fairly sound saying, as no epidemic of water-borne disease ever did affect the army in France.

The strength of the division is 26,536. We now have a swagger Divisional Rest Station in the École Professionnelle in Armentières, and I hear talk of getting extra tables, chairs, games, books, etc. Why Brother Boche allowed us to do all this settling down in Armentières, I do not know. He could shoot up the whole town any time he liked, could even spray the suburbs with machine-gun bullets. I have seen him doing it. I have seen the chickens in a back yard out Houplines way, running about after the little splashes of dust kicked up by the bullets, thinking, poor things, that someone was throwing them nice things to eat. And yet Brother Boche held his hand and was satisfied with a regular "hate" just now and again.

In all this rigmarole I am forgetting about my "home life" in the mess. We were a very friendly party on the whole. My chief was full of amusing ways. His regularity of life was amazing. This was his daily routine: Breakfast, 9 a.m., smoke a cigar. Office, 10 a.m., smoke several cigars; start off round field ambulances, billets, bath house, rest stations, or whatever was the daily programme. Lunch, 1 p.m., smoke a cigar. Walk till tea time. Office again until dinner, cigar. Bed at 10 p.m. to the tick. During his afternoon walk he entered into conversation with any stray old Frenchman he met, and they were all old Frenchmen even in 1915. He talked no French, and addressed them in all sorts of playfully opprobrious terms to which they cheerfully smiled and nodded. Saving your presence, his generic term for all Frenchmen was "tare-arse," a word I have never heard before or since.

Another of his little jokes was to point up to an airplane and shout, "Look out,—Alleman." The old Frenchman would look, shake a negative with his finger, and laugh silently at this funny, mad old Englishman, as he probably thought him.

(To be continued.)

A REPORT ON THE EFFECT OF THE MODERN SYSTEM OF TRAINING ON THE RECRUIT.

By Major T. F. KENNEDY, O.B.E.,
Royal Army Medical Corps.

This report deals with the effect which the collective influence of all the different items of the modern system of training has on the physical condition of the recruit. Physical training looms large in this programme, but the report cannot be taken as an index of the effect of the new Physical Training Tables, *per se.*

The results of the tests were satisfactory in the case of all units examined. There appeared to be a steady improvement in the physical condition right throughout the course of training. The improvement is more marked after the first month or so, when the recruit has accommodated himself to the new mode and conditions of life. Temporary set-backs at certain examinations can be accounted for by influenza or other obvious cause.

Weight, chest measurements, vital capacity, strength and co-ordination showed satisfactory increases.

The pulse takes a little time to accommodate itself to the conditions imposed by the training, but in most cases, after the first month, it has done so. It is satisfactory to see that the pulse-rate, after one minute's rest, invariably comes down to less than its "pre-exercise" rate, an indication that the heart is well able to compete with the work.

Comparison of the increases of the various squads (see Appendix II) does not reveal any material differences, other than what might be accounted for by the period of training, between the physical progress of the recruits of the Cavalry, Infantry and R.A.S.C.

Observations and tests were carried out on squads of recruits from the following four units :—

(*a*) Depot of The Queen's Own Royal Regiment.
(*b*) Depot of R.A.S.C.
(*c*) 5/6th Inniskilling Dragoon Guards.
(*d*) Depot of The Royal Berkshire Regiment.

The squads from (*a*) and (*b*) were tested during the summer, and from (*c*) and (*d*) in the winter months.

In all cases the squads took a considerable time in forming, but the first tests were done on the individual recruits immediately after they were attested, the remaining ones being carried out at approximately monthly intervals after the squads had started training as a whole.

To assess improvement in physical efficiency the following points may be considered.

(*a*) Improvement in weight (except in the case of obese individuals).
(*b*) Improvement in chest measurements (maximum and minimum).

(*c*) Improvement in vital capacity (capacity of lungs).
(*d*) Lowering of sitting pulse-rate.
(*e*) A lessened rise in pulse-rate as a result of a standard exercise.
(*f*) Return of pulse to a below sitting pulse-rate one minute after the exercise.
(*g*) Improvement in strength (as indicated by power of grip).
(*h*) Improvement in powers of co-ordination.
(*i*) Quickening up of reaction time.

The figures in respect to the various squads at each examination are given in Appendix I, but the results in respect to the points enumerated in the preceding paragraph are given below.

Appendix II shows the mean increase in each unit during the period of training in respect to weight, vital capacity, chest measurements, strength and co-ordination.

Weight.—This shows a satisfactory increase in the case of each type of recruit, Cavalry, Infantry and Technical Corps. An improvement on previous figures was shown at each examination with one or two exceptions, in which cases the cause was obvious, namely, influenza in the case of the fifth and sixth examinations of the Royal Berkshires and the last examination of the Cavalry recruits. Total increases are shown in Appendix II.

Chest Measurement.—There was an improvement in all the recruits examined in both the maximum and minimum measurements, but it was greatest in the case of the Infantry, whose training period is four months, as compared with three months in the case of the Cavalry and R.A.S.C.

It will be noted that in certain cases an apparent decrease in these measurements takes place at some examinations. The only explanation I can give is the personal "margin of error" in the taking of them; they were all taken carefully by me. This illustrates the variance that is likely to occur in these measurements, and would seem to show that too much trust should not be put in chest measurements alone. A graph comparing the mean increase of expansion (in inches) with the increase of vital capacity (in litres) is given in Appendix III. It is interesting to note that the curves do not always correspond.

Vital Capacity.—This shows a steady increase throughout the course of training in all types of recruit. In the case of the Cavalry and the Royal Berkshires the fifth and sixth examinations show decreases, the result of influenza and associated catarrhal conditions.

Lowering of Sitting Pulse-Rate.—In the case of both Infantry squads it was not until the fifth examination that the pulse came down to the original rate. There was no sign during this period of any cardiac distress; the exercise tolerance was good. The rise in the case of the sixth examination of the Royal Berkshires can be accounted for by the prevalence of influenza.

The pulse of the R.A.S.C. squad came down below the original rate

after the second examination. In the Cavalry squad it never exceeded the original rate.

Several individual recruits suffered from tachycardia, having resting pulse-rates well over 100 per minute. These were very carefully watched at each examination. No organic defects were noted in their hearts. They practically all lost the tachycardia towards the end of the training period and none appeared to suffer from any disability. It is difficult to tell in some cases to what extent the tachycardia is due to inherent nervousness of medical examination.

Effect of Exercise on Rate.—In the case of the Queen's Own Royal Regiment there is not a lessened rise in the pulse-rate as a result of a standard exercise until the sixth examination. In the Royal Berkshires there is a steady lessening in the rise in the first part of the period of training, but in the latter part it increases again, probably as a result of influenza, etc.

The R.A.S.C. show a steady lessening throughout the examination. The Cavalry resemble the Royal Berkshires in that the examinations during the first part of the period of training show a steady decline in the rise; but influenza and other catarrhal conditions cloak any further decline that might have been evident in the latter part.

After One-Minute Rest.—There is a satisfactory drop in the pulse-rate to below the pre-exercise sitting rate in every examination for all squads. This points to the fact that there is no sign of cardiac strain and that the heart is "on top of" its work.

Strength.—There was a satisfactory increase in strength of grip in both hands for all the squads. The Royal Berkshire squad show the highest increase. The Cavalry recruits come second.

Co-ordination.—This shows a satisfactory increase between the initial and ultimate examination. The Royal Berkshire squad show the best increase, the Queen's Own Royal Regiment come second, but one would expect this as the Infantry have a longer period of training.

The figures do not progress in all cases at each examination step by step, but I think one should expect this type of pendulum swing in a factor like co-ordination which depends on so many complexes.

Reaction Time.—This was taken for both auditory and visual stimuli. The results were not satisfactory, fluctuating between increase and decrease. It is thought that the reliability of the apparatus is largely dependent on the strength of the battery used; a run-down battery results in longer reaction times being registered.

Other Observations.—(*a*) Smoking categories were taken, but the number in each squad was too small for any useful tests to be made as to the effect of smoking on endurance, etc.

(*b*) Alcohol categories were also taken, but practically all the recruits were total abstainers, and of those who did partake the amount of alcohol consumed was so small as to be negligible.

APPENDIX I.

SUMMARY OF EXAMINATIONS OF SQUADS OF RECRUITS.

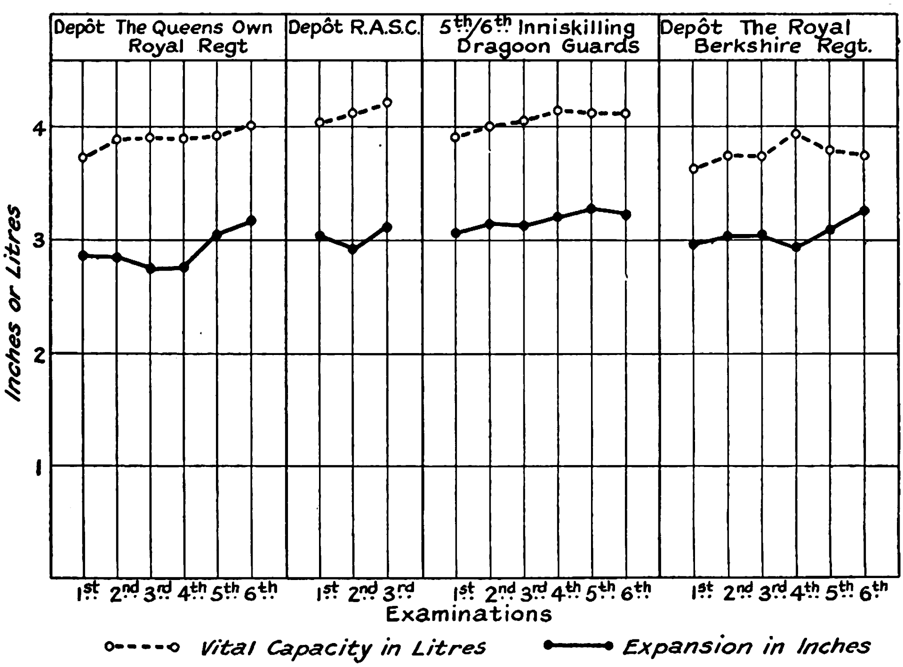
Height cm.	Weight kgm.	Chest			Pulse record			Reaction time		Co-ordination test	Grip		Remarks	
		Vital capacity litres	Maximum inches	Minimum inches	At rest	After exercise	After 1 min. rest	Auditory	Visual		Right Kg.	Left Kg.		
						Queen's Own Royal Regiment.							*Examinations*	
165·36	58·81	3·71	35·26	32·43	78·0	97·88	73·0	20·5	34·72	51·79	38·72	36·83	1st	
165·73	59·82	3·91	35·18	32·33	82·88	105·66	74·55	21·77	40·16	55·71	36·27	34·55	2nd.	13.6.30
165·93	59·92	3·92	35·52	32·77	81·44	102·44	70·88	21·27	29·77	53·1	37·94	36·27	3rd.	10.7.30
166·24	61·19	3·93	35·57	32·82	81·17	97·88	69·05	21·47	31·23	60·09	41·86	38·56	4th.	13.8 30
166·65	61·36	3·91	35·8	32·76	77·52	92·0	68·7	19·88	29·05	58·05	44·07	41·76	5th.	16.9.30
166·46	61·64	3·96	36·0	32·8	71·4	93·0	64·0	21·8	36·57	59·6	43·5	43·0	6th.	9.10.30
						R.A.S.C.								
169·04	60·22	4·06	35·7	32·66	80·88	107·2	72·32	20·76	36·32	59·49	39·64	38·84	1st.	17.4.30—27.5.30
169·68	61·0	4·14	35·62	32·67	81·92	100·08	69·56	20·28	27·84	63·89	40·28	38·0	2nd.	9.7.30
169·88	62·26	4·26	35·82	32·68	77·76	90·88	62·4	20·12	30·28	66·26	43·88	40·70	3rd.	12.8.30
						5/6th Inniskilling Dragoon Guards.								
170·14	59·0	3·93	34·93	31·83	87·35	108·66	75·28	23·28	33·71	56·71	41·82	38·0	1st.	19.11.30—2.12.30
170·48	59·57	4·0	34·84	31·65	85·28	101·85	73·14	22·0	36·96	59·84	43·14	39·85	2nd.	16.12 30
170·4	60·62	4 08	35·01	31·85	82·07	94·37	69·48	22·0	34·70	59·77	44·84	47·80	3rd.	8.1.31
170·75	61·73	4·18	35·13	31·92	82·78	94·35	67·28	21·0	33·71	62·80	44·28	41·10	4th.	10.2.31. Influenza
170·75	67·51	4·15	35·26	31·95	74·0	92·0	66·63	20·04	35·68	64·20	47·14	45·77	5th.	3.3.31 ,,
170·81	61·63	4·16	35·10	31·84	73·63	91·63	62·81	19·18	26·81	62·51	49·13	45·63	6th.	27.3.31 ,,
						The Royal Berkshire Regiment.								
166·47	53·6	3·65	34·44	31·46	88·92	126·0	83·84	23·68	38·6	55·28	34·96	33·8	1st.	15.10.30—10.11.30
166·85	57·24	3·75	34·61	31·60	96·66	118·16	83·58	19·33	33·58	56·85	39·31	37·91	2nd.	9.12.30
167·14	58·34	3·75	34·82	31·76	94·23	104·57	78·85	19·61	35·94	60·74	41·85	41·09	3rd.	6.1.31. Return from Christmas leave
168·43	59·36	3·96	35·17	32·23	94·37	110·87	78·5	20·5	34·4	62·67	44·21	40·61	4th.	9.2.31
166·95	59·11	3·8	35·18	32·11	87·72	105·09	74·54	19·81	35·54	61·4	43·54	42·5	5th.	2.3.31. Influenza
166·93	57·82	3·78	34·90	31·63	89·30	109·30	76 52	18·95	27·13	63·83	45·31	42·18	6th.	30 3.31. Colds

APPENDIX II.

TABLE SHOWING MEAN INCREASE IN EACH UNIT DURING PERIOD OF TRAINING.

Recruits squad of	Weight in kilo-grammes	Vital capacity in litres	Chest measurements in inches		Strength of grip in kilogrammes		Co-ordina-tion %
			Maximum	Minimum	Right	Left	
The Queen's Own Royal Regiment	2·83	0·25	0·74	0·37	4·78	6·17	7·81
R.A.S.C.	2·04	0·2	0·12	0·03	4·24	1·86	6·77
5/6th Inniskilling Dragoon Guards	2·63	0·23	0·17	0·01	7·31	7·63	5·81
The Royal Berkshire Regiment ..	4·22	0·13	0·46	0·17	10·73	8·38	8·55

APPENDIX III.



Graph showing comparison between mean *vital capacity* in litres and mean *expansion* in inches at each examination of each squad.

Editorial.

CEREBRO-SPINAL FEVER.

THE Ministry of Health has recently issued a Memorandum (Special Report, No. 65) on certain aspects of the control of cerebro-spinal fever, particularly in relation to a scheme for collecting the results of serum treatment.

During 1930 and the first quarter of 1931, there was an increased prevalence of cerebro-spinal fever in different parts of England and Wales, and, as Sir George Newman points out in his prefatory note to the Minister of Health, the very magnitude of the literature on the subject creates a difficulty when this relatively rare disease occurs unexpectedly in a district, or in a school or special community. There seemed, therefore, to be a need for a summary of recent knowledge concerning the epidemiology and characteristics of the disease and a precise statement of the means of control and treatment. The present Memorandum amplifies and replaces that on Cerebro-spinal Fever issued by the Local Government Board in 1918.

A short summary of the more important points considered in the Memorandum may be of interest to our readers; more especially as there has been an outbreak of cerebro-spinal fever in the Aldershot Command, and the Report on this outbreak which we publish in this number of the JOURNAL raises several interesting questions in relation to diagnosis and administrative action.

The first section of the Memorandum deals with general considerations and characteristics of the disease.

The recognition of cerebro-spinal fever as a specific disease is attributed to Vieusseaux, who described an outbreak in Geneva in 1805. A brief account is then given of the distribution of the disease, which does not call for any comment as most of the facts are to be found in the ordinary text-books. The disease is world-wide in its occurrence and appears alike in temperate and tropical countries.

In the United States the disease was thought to be more common in rural than in urban districts, but the notification returns in England and Wales do not show any characteristic differences between urban and rural rates. In England, cases may occur all the year round, but the greatest incidence is usually in the winter and spring, with a maximum in February or March. The majority of cases occur in children under 5, and cases over the age of 40 years are rare.

The ordinary sporadic occurrence of cerebro-spinal fever has no direct relation to any particular occupation; but epidemics have usually been

associated with conditions of overcrowding, lack of ventilation, excessive humidity, fatigue and inclement weather.

Epidemics of cerebro-spinal fever may follow in the wake of other infections. This has been observed in particular after influenza epidemics. The sequence, however, is by no means a constant one. The outbreak in the Aldershot Command followed an epidemic of influenza.

During an epidemic, probably 90 per cent of the cases will show a typical clinical picture. Among the atypical cases some 2 to 3 per cent will be fulminant; in these the septicæmia is so profound that meningeal symptoms have not time to develop before coma and death supervene. In such cases the cerebro-spinal fluid may be clear. They usually show a purpuric rash.

Mild attacks lasting from six to nine days are often found towards the end of an epidemic. These cases may be mistaken at first for influenza or typhoid fever, but some degree of neck rigidity and Kernig's sign are usually present, and the cerebro-spinal fluid is slightly turbid with a few meningococci.

In other cases there may be acute symptoms at the onset, but these rapidly subside and convalescence appears to be established in a few days. Neck rigidity and Kernig's sign are nearly always present and there may be retention of urine.

Patients are seldom acutely ill for more than two weeks, but if they do not recover within this period the condition may become subacute and last for weeks with recrudescences. Complete recovery may take place, or various forms of paralysis may remain.

The ordinary case mortality for cases not treated with anti-meningococcal serum varies from 25 per cent to 90 per cent.

It is stated in the Memorandum that cerebro-spinal fever most often follows an infection of the nasopharynx. The theory most widely held is that the cocci are disseminated by the blood stream, but Le Gros Clark has shown that in rabbits fluids dropped into the nasal cavities may reach the brain within one hour, passing by way of the perineural sheaths of the olfactory nerves to the subarachnoid space, and this direct path of invasion must be considered possible with the meningococcus.

For the purpose of confirming the clinical diagnosis of a case the determination of the presence of meningococci in the cerebro-spinal fluid is all that is required. This statement is important and we think it will be useful to refer to the difficulties which may be found in determining the presence of meningococci in the naso-pharynx.

Before the severe outbreak of cerebro-spinal fever which occurred during the War, Lunckenbeim and others had indicated the existence in the nasopharynx of cocci indistinguishable from the meningococcus in morphological, cultural, and fermentation characters, but distinct from it serologically. Research work by Gordon and his co-workers during the War showed that for accurate identification of the meningococcus in nasopharyngeal secretion the agglutination test was indispensable.

In an investigation of meningococci from the cerebro-spinal fluid of military cases of cerebro-spinal fever, Gordon and Murray found by agglutination and absorption tests that these could be classified into four groups, viz., I, II, III and IV. Group I was most prevalent in 1915, and Group II from 1915 onwards. These types were found to be quite stable. They were subcultured for over four years and no mutation occurred. Passage through mice also failed to produce any alteration in type. In 1915 "mono-typical agglutinating sera for each of the four types were prepared, and from then onwards no meningococcus-like organism obtained from the nasopharynx was allowed to rank as a meningococcus unless it showed serological identity with one or the other of the four types of established meningococci."

Gordon also showed that in the cerebro-spinal fluid of a case of cerebro-spinal fever there is only one type of meningococcus present and that the meningococcus in the nasopharynx is serologically identical with that occurring in the cerebro-spinal fluid of the same patient.

He also found that a carrier as a rule carries only a single type of the meningococcus throughout, and when the distribution of types in cases was compared with that found in the nasopharyngeal secretion of carriers in the neighbourhood the correspondence was often very striking.

The Memorandum of the Ministry of Health states that at the present time bacteriologists are often asked to specify in their reports the type of meningococcus present. Such reports cannot now be given with the same confidence since the standard type strains and serums formerly in use have deteriorated in the intervening period and it has not been possible in the absence of epidemic prevalence of the disease to replace them. Their preparation so far as the material now available permits is, however, now in progress.

The transmission of the meningococcus from person to person is affected by direct transference of infection from the mucous surfaces of the mouth and nose as the result of coughing, sneezing, loud speaking or other means of "droplet" infection. As the meningococcus cannot survive at temperatures much below that of the human body indirect infection is of relatively little importance.

While the transmission of the meningococcus from person to person is common, it is unusual for a patient to have been infected by another patient suffering from cerebro-spinal fever. The great majority of infections are derived from persons who are unrecognised carriers of the meningococcus.

During the war the incidence of defined types of the meningococcus in the nasopharyngeal secretion of the military population of Caterham was determined by weekly observations carried out between August, 1916, and July, 1919. During the summer months the carrier rate of the defined types did not exceed two to five per cent. Before cerebro-spinal fever commenced the carrier rate showed a warning rise, the danger line being in the neighbourhood of twenty per cent. At the height of the outbreak the carrier rate was about sixty per cent.

According to the Memorandum most populations in England would be found to yield healthy carriers at some time or another if good sampling by examination of nasopharyngeal swabs were made. When cerebro-spinal fever is locally prevalent, or occurs in institutions, it is usually found that the carrier rate is high.

The duration of the carrier condition in a healthy person is said to be two to three weeks, but in an actual case of cerebro-spinal fever the carrier condition may continue throughout and beyond the illness. Chronic carriers both among healthy persons and convalescents from cerebro-spinal fever, who remain carriers for a year or so, are known to occur especially among those with some abnormality of the nose and pharynx.

The second section of the Memorandum deals with control and treatment.

The case of cerebro-spinal fever should be removed to hospital, and the Memorandum states explicitly that the measures of disinfection required are practically limited to articles likely to have been soiled by discharges from the nose and throat.

Disinfection of a barrack room and its contents would not therefore be required.

Apart from good nursing the essential treatment of cerebro-spinal fever is stated to comprise: (*a*) early and repeated lumbar puncture to relieve pressure and promote drainage of the cerebro-spinal system, and (*b*) administration of anti-meningococcal serum with the first lumbar puncture and its continued administration every twenty-four hours until recovery appears to be established and the cerebro-spinal fluid becomes clear.

In Roumania, Professor Cantacuzène has found that intrathecal injection combined with an intramuscular injection of polyvalent serum has given good results.

The Memorandum contains some very pertinent remarks on the value of anti-meningococcus serum. Of recent years some very good authorities have asserted that none of the different serums at present available can be regarded as potent against the meningococcus.

The earlier results of serum therapy were undoubtedly good, particularly so towards the end of the War. The cases occurring then were mainly due to one or two types of meningococcus, and owing to the laboratory facilities created during the War the meningococci could be typed and a specific monovalent serum employed for each particular case. The Memorandum states that so far it has not been possible to organize or maintain any corresponding method to deal with the scattered and unconnected cases which occur in the ordinary population at the present time. Moreover, it cannot be asserted that in different epidemic periods the same serological types will prevail, or that the serums prepared with strains which were isolated before an epidemic outbreak will possess the complete range of antibodies required to combat the new infection.

Prausnitz examined a number of strains of American, Danish, English

and French origin, taken from the National Collection of Type Cultures of the Lister Institute, by agglutination and absorption tests with serums prepared from several of these cultures. He found it was impossible to make a sharp division of the strains into definite groups; one strain seemed to pass by insensible degrees into another. He thinks the prospects of producing anti-meningococcus serums of *practical* value are rendered highly doubtful by this antigenic multiplicity.

The Ministry of Health consider that in present circumstances reliance must be placed on the use of polyvalent serums, making use as far as possible of recent strains of meningococci obtained from the cerebro-spinal fluid of new and acute cases occurring in different parts of the country.

The Medical Department of the Ministry is endeavouring, by means of individual case inquiry, to collect and examine all evidence available regarding the results of serum treatment, and is inviting the co-operation of Medical Officers of Health, hospital medical officers and medical practitioners in this matter.

A vaccine may find a useful place in the slow convalescence which is not uncommon in acute, severe or more chronic cases. The vaccine should consist of killed cultures of the patient's own meningococcus, or a strain of similar type, and should be given by subcutaneous injection of fairly large doses, as high initially as 250 millions. There are no satisfactory data as to the use of a vaccine in prophylaxis. In special circumstances, such as the entrance of persons from an uninfected area into a community where cases are occurring, its use, in doses of 500 to 1,000 millions at least ten days before such entrance, should be seriously considered.

In connection with the measures to be taken with contacts the Medical Department of the Ministry of Health consider that it is quite impracticable to employ swabbing of the nasopharynx so extensively as to detect all the possible carriers of the meningococcus in a district, and it has not been possible to eliminate the carrier condition when discovered. Swabbing if attempted at all should be limited to close contacts; but the efficacy of such action in controlling the spread of infection must be relatively slight and there is little justification for it.

In special circumstances, such as the control of outbreaks in schools or limited communities, they think swabbing may give valuable indications.

In the Service, swabbing of recruits joining a depot or unit may reveal numerous carriers and the keeping of these men apart from the troops may prevent an outbreak.

This procedure was found most useful at Caterham. Although only a few recruits joining the depot at Aldershot were examined a very high percentage of carriers was found.

The experience at Caterham during the War showed that in addition to the susceptibility of the individual, dosage is of first importance.

If swabbing of contacts in barracks is attempted, and it is usually necessary, the experience at Aldershot seems to indicate that all the men

in the room should be examined. At Aldershot separation of beds and all the usual precautions in relation to ventilation and washing of food utensils had been carried out during the prevalence of influenza and yet cerebro-spinal fever appeared. The carriers detected in the barrack room did not always occupy the beds adjacent to the case and if close contacts only had been examined many carriers would have been missed.

It seems to us that infection will most probably occur when men are crowded together round a fireplace or in an institution such as a canteen. As we have already seen, dosage is of the first importance, and a maximum droplet-infection would occur in the circumstances mentioned.

The Memorandum states that carriers should not be isolated in hospital. We agree, but consider that they should be housed apart and have plenty of fresh air and exercise. Temporary carriers clear up rapidly without treatment.

There is a good deal of difference of opinion as to the value of local treatment. However carried out it must be under skilful supervision ; the solution used must not set up coryza, and the men must be kept three feet apart during the treatment.

Clinical and other Notes.

STABILITY OF STABILIZED BLEACHING POWDER AND A MODIFIED STARCH IODIDE SOLUTION.

By Major R. C. Wats,
Indian Medical Service,

and

I. W. White,
Indian Medical Department.

The method of stabilizing bleaching powder by the addition of twenty per cent of dry quicklime was first advocated by Rettie, Smith and Ritchie (1918). As a result of their experiments, it was proved that the resistance to heat and moisture of a mixture of lime and bleaching powder was sufficient to enable it to be stored in a tropical climate. These results were confirmed by practical tests, carried out by Aumonier and Elliott (1922). Tomb (1927) agreed that the mixture of quicklime and bleaching powder, when exposed to the atmosphere, remained dry and did not corrode the tin containers, but could not confirm the statement regarding the loss of chlorine.

Having recently had an opportunity of analysing eighty-eight samples of stabilized bleaching powder, we have thought it worth while to record the results.

I.—Samples Manufactured in 1922-23.

Sixty out of these eighty-eight samples, which had been stored in a local hospital, were manufactured in 1922 or 1923. The containers of these powders were large, closely-stoppered glass (pickling) bottles, and no smell of chlorine was perceptible before opening them. The amounts of available chlorine in these samples are given at the end of this paper; but it may be stated here that all these powders, when opened, were white in appearance and absolutely dry. Twenty-nine of the sixty samples (48·3 per cent) were very deficient in available chlorine, viz., fourteen of these contained under 2 per cent, ten under 4 per cent, three under 6 per cent, and two, 7 and 10 per cent respectively. The rest ranged from 19·5 to 26·5 per cent, except two which had 28·5 and 30 per cent of chlorine each. The two latter results were doubted, and titrations were carried out repeatedly by two different methods (thiosulphate and arsenious acid solutions) with similar results. One of these results was confirmed by the local chemical examiner, who found the sample to contain over 30 per cent chlorine and 32 per cent *of free lime.* It may be mentioned here that the last five years' average maximum and minimum temperatures of the station were

90° F. and 43° F. respectively, with an annual rainfall of about sixty inches.

II.—Samples Manufactured in 1930.

Twenty-eight samples were received recently from the Medical Store Depot, Rangoon, in tin containers with tight-fitting lids, and before opening the tins no smell of chlorine was perceptible. On opening the tins, some of the samples were greyish in colour and slightly moist (average loss of weight in a hot-air oven being 0·58 per cent). This discoloration had no relation to the chlorine content. It should be noted in the table that seven out of the twenty-eight samples had a chlorine content of 1·7 per cent, one a content of 12·4 per cent, the rest ranging from 21 to 28 per cent.

It was noted that all the tins and bottles containing samples with low chlorine content seemed to be full to the brim. Normally, in the containers having a standard weight of the powder there is an empty space of a couple of inches at the top, but this was not so in the case of the deteriorated samples. This increase in volume of the powder is probably due to absorption of moisture from the atmosphere.

Amount of Chlorine Available in Specimens of Bleaching Powder Examined at the District Laboratory, Maymyo.

Serial No.	Date given on bottle	Amount available chlorine	Serial No.	Date given on bottle	Amount available chlorine
1	1923	23·075 per cent	38	1922	3·55 per cent
2	1922	3·55 ,,	39	,,	1·77 ,,
3	,,	5·325 ,,	40	,,	10·65 ,,
4	1923	26·623 ,,	41	,,	3·5 ,,
5	1922	23·07 ,,	42	,,	1·7 ,,
6	,,	23·07 ,,	43	,,	30·175 ,,
7	,,	24·85 ,,	44	,,	1·7 ,,
8	,,	24·85 ,,	45	,,	1·7 ,,
9	,,	1·775 ,,	46	,,	3·5 ,,
10	,,	5·325 ,,	47	,,	3·5 ,,
11	,,	23·075 ,,	48	,,	1·77 ,,
12	,,	3·55 ,,	49	,,	24·8 ,,
13	,,	21·3 ,,	50	,,	26·6 ,,
14	,,	23·075 ,,	51	,,	23·07 ,,
15	,,	23·075 ,,	52	,,	23·07 ,,
16	,,	21·30 ,,	53	,,	26·6 ,,
17	,,	1·775 ,,	54	,,	3·5 ,,
18	,,	26·625 ,,	55	,,	3·5 ,,
19	,,	26·625 ,,	56	,,	23·07 ,,
20	,,	26·625 ,,	57	,,	3·5 ,,
21	,,	10·65 ,,	58	,,	26·6 ,,
22	,,	21·3 ,,	59	,,	26·6 ,,
23	,,	24·85 ,,	60	,,	7·1 ,,
24	,,	24·85 ,,	61	1930	21·0 ,,
25	,,	26·62 ,,	62	,,	26·6 ,,
26	,,	28·4 ,,	63	,,	1·7 ,,
27	,,	5·325 ,,	64	,,	21·0 ,,
28	,,	28·4 ,,	65	,,	1·7 ,,
29	,,	19·525 ,,	66	,,	21·3 ,,
30	,,	26·625 ,,	67	,,	26·6 ,,
31	,,	3·55 ,,	68	,,	23·07 ,,
32	,,	23·075 ,,	69	,,	26·6 ,,
33	,,	1·77 ,,	70	,,	1·7 ,,
34	,,	1·77 ,,	71	,,	21·3 ,,
35	,,	30·17 ,,	72	,,	1·7 ,,
36	,,	21·3 ,,	73 to 88	,,	Three samples gave a chlorine content of 1·7 per cent and one was 12·4 per cent
37	,,	1·77 ,,			

Summary of Results.

(1) Forty-eight per cent of sixty samples of stabilized bleaching powder deteroriated during eight to nine years storage in a tropical station with an average maximum and minimum temperature of 90° and 43° F., respectively, and an average annual rainfall of sixty inches.

(2) Seven (25 per cent) out of the twenty-eight samples which were about a year old yielded 1·7 per cent and one 12·4 per cent of available chlorine.

A Modified Starch Iodide Solution.

For sterilization of water, it is essential to test the amount of bleaching powder required by means of Horrocks' box. This apparatus forms one of the most convenient ways of testing samples of water and for determining by means of the latest modification the amount of available chlorine in the bleaching powder. The only component part in the box which seems to be unstable is the starch iodide solution. The formula given on the lid of the box contains fifty per cent of glycerine to prevent fermentation of starch, but all the same iodine is set free after variable periods. One of us (R.C.W.) noted that the starch solution used for chemical work was made in saturated saline and kept in a good condition for a long time, and suggested the following modification:—

(i)	Pot. iodide	½ ounce
	Saturated sodium chloride solution	2 ounces
(ii)	Amylum	15 grains
	Saturated sodium chloride solution	2 ounces

Boil No. (ii) until mucilaginous and add to No. (i), make up to 4 ounces.

This reagent was kept in the incubator as well as at room temperature in Central India for three months but remained opalescent and sensitive at the end of the experiment.

The formula given in Field Service Sanitary Notes, India, 1919 (Section 62), is much more economical, containing half a drachm of potassium iodide and half a drachm of starch, each in five ounces of water. But the substitution of saturated salt solution for water would preserve the solution for a long time. The addition of half an ounce of potassium iodide to four ounces of the test solution has been retained in the formula given above so as to keep the quantities equal to those given in the instructions supplied with Horrocks' box, but the solutions given in Field Service Sanitary Notes would be much more economical and just as sensitive.

References.

Rettie, Smith and Ritchie. *Journal of the Society of Chemical Industry*, 1918, xxxvii, No. 23, pp. 311, T and 392, R.

Aumonier and Elliott. *R.A.M.C. Journal*, 1922, vol. xxxix, p. 459.

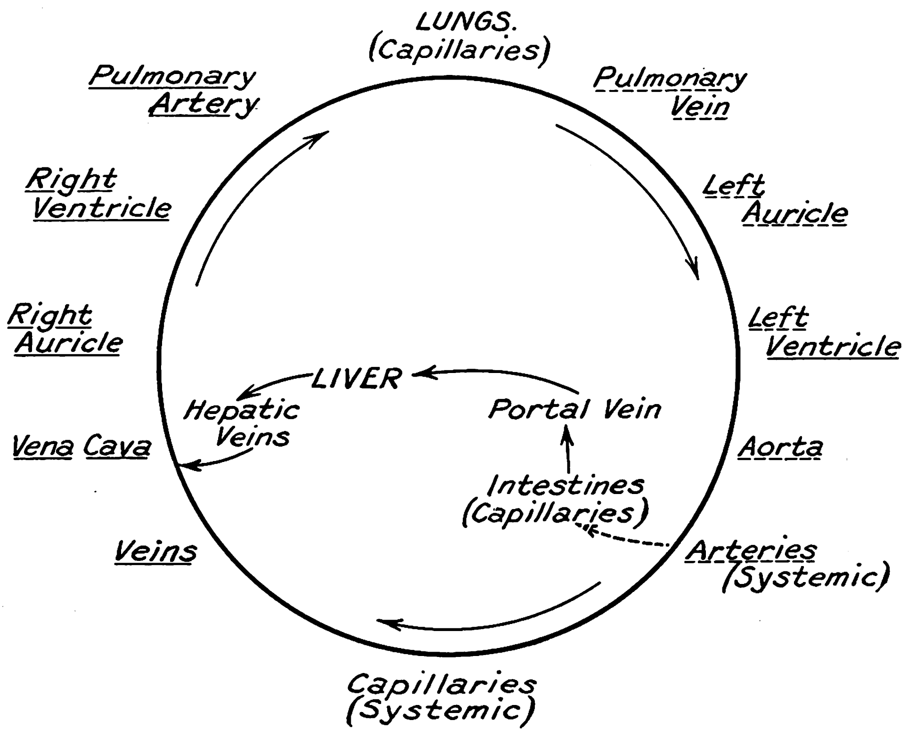
Tomb. *Transactions of the Seventh Congress (Far Eastern Association of Tropical Medicine)*. 1927, vol. iii, p. 553.

A SIMPLE METHOD OF TEACHING THE CIRCULATORY SYSTEM.

By Major A. E. S. PRINGLE-PATTISON,
Royal Army Medical Corps.

By the use of the clock-face or *circular* diagram the fact that the blood *circulates* is impressed on the student.

The circle can be entered at any point on the circumference and the course of the blood from the point of entry follows naturally the clockwise direction.



The portal system is more clearly indicated as a short circuit included within the circle, not as a separate mechanism as shown in the diagram in Royal Army Medical Corps Training, which often appears difficult for the student to grasp.

The renal circulation has purposely been omitted, as it would complicate the diagram, nor, unlike the portal system, does it cause the student any difficulty.

ACUTE YELLOW ATROPHY OF THE LIVER.

By Captain W. SCOTT,
Indian Medical Service.

The patient, a female, aged 36 years, was admitted to hospital on July 25, 1931.

Previous History.—The patient was a married woman. She had had three pregnancies, one stillborn. The youngest child was aged 2 years.

The patient was said to have suffered with a "weak stomach" in childhood. In her second and third pregnancies, she had had albuminuria in the later months, but no vomiting. She was under medical supervision for the last six months of her last pregnancy, and the husband was informed that there was "something wrong" with her liver. After delivery, the albuminuria cleared up, and the patient had never shown symptoms of kidney disease.

One month ago, she had "sciatica" of the right leg, for which atophan was prescribed. She received 120 grains of this drug in the following fortnight.

The present illness commenced a fortnight ago, with jaundice, vomiting and diarrhœa. The patient is stated to have passed blood per rectum at the commencement of the attack. The stools were very pale.

The condition was thought to be one of simple catarrhal jaundice, and treatment for that condition was given (calomel in small, repeated doses). Instead of clearing up, however, the jaundice gradually deepened. On the day before admission vomiting was excessive, and her condition gave rise to alarm (apparently for the first time).

Between 6 p.m. and 8 p.m. on July 24, the husband noticed a change in the patient's mental condition. She appeared listless and confused, and forgot simple household details.

At 8 p.m. she became unconscious, and developed twitching of the whole body. There were no definite "fits."

Owing to difficulties of transport, she could not be admitted to hospital until 7.30 a.m. the next day.

Condition on Admission.—The patient, a stout, heavy woman, was in a state of coma, and had stertorous breathing. The whole surface of the body was of a deep greenish-yellow colour, in which the conjunctiva participated. The pupils were equal, of moderate size, and reacted to light. The patient's head moved away from the light of the examining torch. The whole body was involved in twitching. The lower jaw moved constantly from side to side in a grinding movement. There did not appear to be any difference in the tonicity of the muscles of the limbs on the two sides. The knee-jerks were present and equal. The plantar reflexes were doubtfully extensor. The superficial reflexes could not be elicited.

The heart was noticeable for the softness of the first sound. The second

sound in the mitral area was unusually loud and sharp. There were no bruits heard. The lungs were clear.

Abdomen.—No liver dullness could be demonstrated by percussion. The spleen was not felt. There was no abdominal distension.

Urine.—Albumin and sugar were absent. Bile present. Acetone and diacetic acid absent. Leucin crystals present.

Van den Bergh.—Biphasic reaction.

Lieutenant-Colonel G. F. Dawson, R.A.M.C., Medical Specialist, saw the case at 10 a.m., and diagnosed "cholæmia," and recommended intravenous glucose and sodium bicarbonate.

Two pints of a 10 per cent glucose, with 5 per cent sodium bicarbonate solution, were given intravenously. The effect of this injection was marked. The coma was markedly lightened, and the patient attempted several times to cry out. The corneal reflex returned. There was, however, no actual return of consciousness.

At 4 p.m. the temperature was 100·8° F.; pulse rate, 120; and respirations, 28. The pulse was thready. Per rectum, one pint of glucose and sodium bicarbonate solution was given, and the heart stimulated with strychnine and digitalin. Thereafter, the pulse regained volume. Oxygen was administered for ten minutes.

By 6 p.m. the temperature was 100·4° F.; pulse, 132; respirations, 30. Rectal saline (ten ounces) was given, and retained. At 7 p.m., pituitrin ½ cubic centimetre was injected. At 8 p.m., normal saline (one pint) was given subcutaneously. Camphor in oil (one cubic centimetre) and oxygen for ten minutes were also given.

At 9.30 p.m. the pulse was uncountable. The temperature had risen to 102° F. Respirations were 40 per minute.

The patient died at 10.15 p.m., without having regained consciousness.

Post-mortem Notes.

Permission was obtained for a partial autopsy only.

On opening the abdomen, all the tissues were seen to be stained deeply a greenish-yellow colour. There were numerous hæmorrhages in the wall of the gut, and in the mesentery.

The liver was much reduced in size. It was not removed entire, but from several pieces removed for section it was seen to be diffluent and discoloured. Some areas were of a purple colour, and others of a greenish-grey. It was estimated that the organ was half the normal size.

The report on the liver tissue was as follows:—

"The section shows complete degeneration of most of the liver cells. An appearance consistent with that of acute yellow atrophy of the liver is shown."

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (Ret.).

(*Continued from page* 309.)

We left Mashobra on June 1, 1898, and started for the interior by the Hind Tibet military road. It was early for travellers, who usually preferred the autumn for such an expedition. Our route would lie principally along high hills and some valleys, but scarcely anywhere lower than 5,000 feet above the sea-level. The march would bring us into close proximity with some of the highest mountains in the world; it was no wonder that we looked forward with pleasure and curiosity to our trip.

My wife and I, four servants, three ponies, and about twenty bearers, comprised the party. After the usual difficulties with the porters we were soon up the hill to Mahasu and could see the lie of the land we should cross. Standing up boldly in front were the two Chalets flanked by mountains rising higher and higher in the distance behind them. Passing through Theog and Matiana we reached Narkanda on the third day. This is a favourite place for Simla folk to run to from the gaiety and seek a short rest. The approach to this place is up a long winding hill where a magnificent view bursts on the travellers. A vast panorama extending for hundreds of miles opens out, displaying the eternal snows in all their glory. There is no sight to rival a view of the Himalayan snows at this season of the year. The clear shining whiteness is arresting.

Below were stupendous gorges, ranging one after the other, at the bottom of which the River Sutlej and the Abbasind (Father of Rivers), more commonly called the Indus, hastened to the plains.

Replenishing our stores and putting a final touch to everything, we left this pleasant place and plunged into the Bagi Forest. It was a lovely day and the forest was at the zenith of its beauty. Birds of all hues in full plumage shimmered in the bright rays of the summer sun as it streamed and filtered through the foliage. There was much grass and here we picked a feast of wild strawberries of a delicious flavour. A most striking feature was the size and magnificence of the teak trees, especially on the side of a steep khud (precipice), where they had always defied destruction by man. For centuries these sylvan giants had grown and flourished undisturbed, and then at a great age decayed and fell. I do not know the exact height to which they attain, but I judge many to be 150 feet and possibly more. These trees, as is well known, enter largely into the building of

ships, etc., and contain an oil which preserves the nails driven into the wood. A section of the stem shows well-marked rings, hard alternating with soft ones. The soft wood is formed during the rapid and luxuriant growth of the tree during the monsoon, when it is covered by enormous leaves. The hard and dark rings of wood represent the cessation of growth during the cold and dry season, when the trees shed their leaves and stretch their bare branches to the brazen sky. A week later we reached Bhali in the heart of wild Bussahir. The forest house here rests on a spur about forty miles from Simla. We were at 8,000 feet, and opposite to the Kulu country with high ranges of mountains, but not so high as in the direction of Tibet. Hardly had we left Bhali the next morning when we met Major and Mrs. H. returning from the interior and carrying Boxer, a dog I had given them, which had been badly mauled by a leopard. Boxer was a plucky dog and had fought desperately, escaping with seventeen wounds. Our course lay down a long slope to the valley and 3,000 feet below Bhali. We had not proceeded far when our passage was arrested by a break in the road. There had been a small landslide which had carried away the path, and the only connection was a tree trunk over a chasm of some depth. A fall here would have been fatal, yet the hillmen were crossing and recrossing gaily and with absolute confidence. We were led over, and a nerve-racking experience it was. Down and down we walked and the heat increased till we reached the Nogri stream and the small and pretty rest house at Tachlech. It was very hot and close, but we were delighted with marvellous butterflies and the wonderful fronds of the *Osmunda regalis* which was abundant. Mosquitoes abounded and we suffered as we had no curtains to protect us from them. In front of the rest house rose the Darran Mountain, a long graduated slope which we had to climb next day. An old native warned me to start early, but of course I knew my own business best. On the following morning we strolled off at 8 a.m. instead of 3 a.m., as we found to our cost later. It was a different class of march to any previous one, the first three miles being occupied in scrambling over rocks in the bed of the river, and it was not till 11 a.m. that we started to climb the eight miles up the mountain with a burning sun on our backs, which we might have avoided by starting early. We had no ponies to help us, as we had sent them round by another route to meet us later. We began to feel the heat very much and were becoming tired. I rigged a hammock stretcher for my wife and walked on myself. The hillmen soon whisked my wife up the hill and I followed slowly, but was anxious not to take any risk in the terrific heat. I determined to rest where I was till 4 p.m., when the evening shades would be on this side of the mountain. At about 3 o'clock some men passed me and I bribed them to carry me to the top for 1s. a head, and six strong fellows carried me to the rest house. I had learned a lesson and felt humble when I thought of the advice of the old native of Tachlech.

After the fatigue we determined to rest for a day on the top of this

delectable hill. The small rest house was quaintly situated in the forest, which began here and extended to the north as far as we could see, and our path could be traced through it.

We were entering another class of country, and the scenery took on the grandeur of the mountains yet in our path. As the sun sank in the west the peaks appeared in a variety of colour, reflecting reds, greens, blues and yellows, with all their half shades blending and changing as in a kaleidoscope, giving the most lovely effects. Sometimes the peaks would be absolutely golden, and the marvellous light would slowly and gradually fade till lost in night. Even then there was sufficient light to be able to distinguish those silent, ancient sentinels of the world. The vastness, the stillness, the loneliness of these mountains in the distance, together with the whistling of the wind through the forest ; the cry of some bird struck by another feathered marauder ; and the curious cry of a panther or leopard, were most impressive as I sat in our verandah, looking out, listening, and wondering at it all.

Our spirits were high in the morning, and in our health and strength we danced down the road. The bracing air, the bright sunlight, the joyousness thrilled us. Every bird seemed to smile upon us ; everything seemed to welcome us. But we had twenty-five miles to go and realized the necessity of saving our powers, so became steady and planted our feet well and made good progress. It was not long before we reached a small hamlet called Moshnu, consisting of a few huts ; the natives came out to see us. I found an industry flourishing here. Apricot fruit grows in great abundance and is stored up for food in the long winter. At the edge of a precipice we espied a huge, conical receptacle filled with the fruit and being crushed by large, weighty pestles of wood, worked by a system of levers. The force expressed the oil which was collected underneath. It was very sticky and crude, with a bitter taste. It underwent some rude form of refining, but I did not see how this was done. The receptacles varied in size, and in one or two cases weights and screws were used, reminiscent of the Brahma press. Oil is also expressed from the wild olive, walnut and other trees, and in the same way.

At the bottom of this slope, close by a river, we met our ponies, and halted for breakfast. Our Benjamin, or head servant, was a Madrassi, and a Christian of the Protestant sect. He had two very strong points, one was laziness and the other a *penchant* for drink ; but in his present job he had no chance of displaying either, and consequently did his work as a servant very well. Our breakfast table was laid close to a delicious mountain stream, the water of which came from giddy heights above us and flowed over little rocks and obstacles, forming delightful miniature fountains and cataracts, while a short distance away was a waterfall ending in a rock basin of worn stone, singing in the sunlight and throwing up a white, misty spray. In this were forming numberless little rainbows, while the larger drops of water shimmered and reflected all the colours of the spectrum.

After a good breakfast, in which tinned sausages were a feature, we had a wash at this beautiful place, and then started on the remaining eleven miles of our trek. My wife and I mounted our ponies, and the third one was taken by Benjamin, while his wife held his stirrup. I interfered, as I could not tolerate the lady walking under these circumstances. I put her on the pony, and her swain had to "leg" it. Benjamin would preach to his fellows, and was regarded as an apostle or, at any rate, a person of considerable sanctity. A little later the apostle's wife accidentally slid over the crupper, and fell to the ground. This was not the place for such evolutions, for she was only just saved from going over the khud. The last two hours of this march were very hot, for we had lingered too long and had lost the shade of the earlier hours, but at last saw the palace of the Rajah of Bussahir and Kunawar, and soon were resting in the Sarahan forest house.

It was about 4 p.m., and very peaceful and pleasant. We had enjoyed a good tiffin and sleep; our horses were eating their grass; the bearers were lying about sleeping and grunting; while Benjamin smoked his pipe, resting his back against a tree. In front of us was a small range called Pundra-bis. Sarahan lies on a straight piece of road above the Sutlej, which could be distinctly heard rushing over its rocky bed. There are only a few native houses in the bazaar, and, stretching up the hill behind the bungalow, was the summer palace of the Maharajah. This prince had sat on his gadi for more than fifty years, and was now very old, but still an active man. Hearing of our arrival, he sent a messenger with a letter cordially welcoming us to his country, and intimating that he was giving himself the pleasure of making our acquaintance and asking when it would be convenient to receive him. I replied at once with all the politeness I could command. Our servants arranged a sort of Durbar scheme in the verandah, and we awaited the arrival of our visitor.

Suddenly I heard guns firing, and, looking out I saw the Rajah approaching. He was seated in a blue and gold palanquin, carried by eight men in rather worn uniforms and with little skull caps on their heads. He was firing left and right at beautiful mynahs which were being liberated on each side of him. He hit some, but the majority escaped. Surrounding the palanquin was a motley crowd of ministers and others, down to link boys, and some grooms leading horses. The scene was gay but very odd. On his arriving at the bungalow, I walked to the edge of the verandah, met His Highness, and we mutually saluted. He was helped up the steps, and immediately asked me, "What is the health of the Queen Victoria?" I replied that when I last heard, Her Majesty was very well. He then inquired after the Viceroy, and I told him that I thought His Excellency was keeping his health very well under the strain of government.

Shumshere Singh was an emaciated small man, with not a very pleasant expression; he had no personality, and was a cypher in his own State. However, he wished to be hospitable and ordered *purwanas* to be made out for us, directing everyone to attend to our requisitions for food,

grass, etc. Later we discovered that they were of no value. He examined my camera and wished me to take a photograph of him, so I promised to do so on my return. He then got on to a pony and rode slowly back to his palace.

Early the next morning we mounted our horses and commenced a fourteen mile march to the next stage at Taranda. There had been rain during the night, so the air was delightfully refreshing. Passing close to the village of Sarahan and by several small flour mills for about a mile, we turned into the forest again, and soon came to our first waterfall. The water was bounding down the rocks, and we determined to have a clean up. Having completed our toilette, we emerged on to a road cut out of the face of the cliff over a precipice of 600 feet. Formerly there was a gallery here fixed into the rock; in 1864 Sir Alexander Lawrence fell through and was dashed to pieces. The spot was marked by a cross for some years, but it had fallen recently and had not been replaced. There have been many accidents along this road.

Marching on, we were suddenly hailed by some persons approaching, who turned out to be Surgeon-Major H. and his wife returning from Nachar. Mrs. H. was terrified by the danger and discomfort, and refused to advance another mile. Unfortunately, she communicated her views to my wife and made her feel a little nervous, but this soon passed off. A certain amount of discomfort is to be expected in an undertaking of this nature but, considering all things, we had travelled comfortably so far and our stores were lasting very well. After a short conversation we hastened on to our breakfast, which had been prepared at the commencement of another formidable range of the Dralli cliffs. Now the road became very bad and difficult, especially for my wife. However, she went at it and soon we were resting after a horrible ride. The scenery was becoming very wild and different to anything I had ever experienced. Descending many feet, I found some good watercress and laid in a supply. We now began to ascend to Taranda. There was really no road, but the horses sprang from rock to rock safely, for luckily I had removed their shoes so that they had a foothold. At last the going became less dangerous, and a short distance brought us to a knife-edge coll, and just over this was our rest house and the beginning of another wonderful march. After tea I went into the verandah and looked down the new valley, along whose elevated sides we should march. It was a clear, beautiful evening, and night was beginning to close in the lower reaches of the river and valley; the dark shadows were slowly climbing the mountain sides, while in the remote distance there was a round peak of pure gold. This was mighty Raldang, with the rays of the setting sun throwing a wonderful golden light on its snows. As the minutes passed so the lights changed in colour, density and strength till they disappeared in the shroud of night. These remarkable effects are quite unforgettable.

My party were all tired with the last march, so I postponed starting

the next day till 1 p.m., and decided to proceed only four and a half miles to Paundha. This was a gentle drop all the way and on a better road. The most striking feature of this place was the roar of the waters of the Sutlej. It was deafening.

The rest and easy march had enabled us to recover our strength and, enthusiastic as ever, we started for the great forest of Nachar, and soon reached the bungalow, which was at the edge of the forest itself. The enormous pine trees attracted me; they were the largest I have ever seen. A letter was waiting me here from Mr. H. C. Robertson, the assistant engineer of the road, begging us to await his return, and to use his house as we liked. However, we were pledged to a forward policy, so I wrote and hoped that we might meet him as we returned. This we fortunately did at Paundha, and spent a very pleasant evening with him. The forest was very dark and gloomy, and we were not sorry to be off again to Wangtu and Urni. This was a long, difficult march. At first we travelled by a winding road down to the Sutlej at Wangtu, where there was a remarkable old bridge, which has since been replaced by a horrible iron structure quite out of keeping with the surroundings.

There was little of interest at Wangtu except the old bridge. This had been in position for a great many years, but was now not safe. It was a wooden bridge made of logs placed crosswise and filled up with stone. I believe chains and fastenings used to hold the structure together, or it would not have resisted the force of the stream.

We are now in the very heart of Bussahir and Kunawar. The former is the more important, while the latter comprises the more mountainous part of the State. The area is about three to four thousand square miles, half of which is mountain. Shumshere Singh has ruled for years and is the oldest Rajah in India; he has occupied his gadi for half a century. The military road has opened up a direct thoroughfare from Tibet and China, and consequently a Mongolian type of feature is common. The River Sutlej divides the State, entering near the chief town of Rampur, and leaving it beyond Chini and the wild country on the borderland of Tibet. The religion as far as Wangtu is chiefly Hindu and some Mussul, but when we crossed the bridge we entered a tract which becomes more and more Buddhist each day. We crossed the old bridge and marched to Urni, 10,000 feet above the sea-level. Opposite to the rest house of Wangtu the Baspa stream falls over a whirling cascade and rushes into the big river. The first portion of the road ran for some miles along the right bank of the river to a place where it divided, the lower part continuing along the right bank and later crossing by the Minneken bridge to Kilba, while the other immediately struck up-hill and away from the river. The path was good, but the ascent steep and fatiguing. I noticed some women carrying loads, and they seemed very tired. They carried about sixty pounds weight on their backs, the load being held by a band passed round the load and crossing their foreheads. The women "run" for loads and

carry them on this march of eleven miles for less than 6d. The men are atrociously idle, lazy and cowardly. Up and up we went for about 3,000 feet above Wangtu. The road at last turned a corner to the left, and we saw the Urni rest house. The march had been a severe one, and I determined that our excellent servants and bearers should reap the benefit of a day's rest at this wonderful spot.

We had run out of fresh meat, so my first task was to obtain this. A native engaged for four rupees (5s.) to fetch me a sheep from the high summer pasture grounds by the snow line, which at this time would be at 12,000 to 13,000 feet. I was interested and watched how he ordered my meat. He stepped to the edge of the precipice and passed the order by calling across and up the mountain, and I heard my order passed by another man to the heights. Later a sheep arrived and was killed. I retained as much as I required and handed the rest to my staff.

The bungalow contained two rooms, and Benjamin had made it very comfortable with a good fire, but we sat in the verandah and looked directly at mighty Raldang. It was forty miles away, and yet the air was so clear that in the moonlight we could see much of the detail of cliffs and gorges. The vastness and immensity of everything was awe-inspiring.

We had now marched ninety-eight miles in ten days, averaging twelve and a quarter miles a day, with two halts each of one day. This was good marching considering we did our own packing, for our Madrassi servants were not of much use in this operation. We retired early and considered our next march by the Mesang and Rogi cliffs. This spelt an effort.

We were up early and started by a descent for two miles, and then crossed a ravine and made a complete turn, which in two miles brought us along the side of the mountain within speaking distance and opposite to the Urni bungalow. Soon afterwards we turned to the left on a safe road but over a very deep precipice.

(*To be continued.*)

Current Literature.

P.D.G. Protection of the Civil Population against Chemical Warfare.
Revue Internationale de la Croix Rouge.

The writer deals with the necessity of developing co-operation between the civil and military authorities and the civil population for the institution of exercises in defence against a chemical attack from the air.

It is considered that this is necessary on account of the great developments of the air arm which have taken place and of the terrific damage which could be inflicted by the combination of chemical with aerial bombardment.

Civil and military co-operation is stated to have been established in many countries, especially in Germany, Poland and the Soviet States.

An anti-air defence exercise took place in Königsberg in October, 1930, and it was described by Herr Fritz Muller in the November, 1930, number of *Luftschutz-Nachrichtenblatt des Flakvereins* and the writer of the present paper quotes from a translation which appeared in the May, 1931, number of the *Bulletin Belge des Sciences Militaires.*

The exercise occupied three days and was drawn up by General v. Mittelberger who, at a preliminary conference, gave a summary of the defence measures employed in Germany against attack from the air. Series of posts would receive information as to air raids from observation aeroplanes.

Königsberg, considered to be the capital of a State at war, was attacked by a squadron of bombing aeroplanes represented by two machines.

On the first day the object of the exercise was to test the efficiency of the system of warning and of liaison with the military defence. "Anti-air Guard Posts" were established, each consisting of six men, who in time of war would be individuals with good sight and hearing, over or under service age and living in the neighbourhood. An air attack was made on a foundry defended by machine guns and then on a fort, after which at another fort a demonstration was given of the firing of machine guns and anti-aircraft guns belonging to the air defences.

These three exercises tested the liaison of the air defence posts with the defence aeroplanes on whose reports the defence measures would be set in motion.

On the second day the object was to test the "Service of Camouflage" in liaison with the Ground Warning Service and the Aeroplane Warning Service. In this test a building was obscured by smoke. It demonstrated the difficulty of determining the moment when the smoke screen should be released.

During the night an air attack was made while troops were entraining in Königsberg railway station. The troops arrived at twenty-one hours with their wagons, machine guns and mortars. The troops were divided into small parties and began entraining into trains which were waiting, practically all lights being extinguished, only essential signal lights were lighted and those only for a short period. The troop trains were moved out from the passenger and goods stations for some distance and then moved back again. The enemy planes were found by searchlight, and anti-aircraft guns and machine guns came into action against them.

Then entraining was carried out under an imagined gas bomb attack followed by a series of bombing attacks by single aeroplanes. The "all clear" signal was given about midnight.

It was judged that the enemy had failed to find their objective.

On the third day the activity of the auxiliary anti-air defence was tested; this consisted of police, firemen, Red Cross men and "the Service of Technical Assistance."

Before the day's demonstrations began a police official from Berlin gave a *résumé* of the duties the police had to undertake during an air attack. He said that these duties are chiefly preventive, the population would be warned by police patrols and by audible signals; the police would also supervise the evacuation of streets and would control traffic; also during and after an attack they would give help in case of fire and of damage to gas and water supplies. They would also give first aid to the injured and would begin disinfection of gassed areas pending the arrival of the special technical service. The police could also give much help in organizing the anti-air guards and in instructing the people generally in the measures to be undertaken during attacks from the air.

The police official stated that there should be in every town a Commission for Anti-air Protection, which should co-ordinate the various services.

In the exercise a police barracks was supposed to represent a section of a town. Defence aeroplanes gave notice of the approach of enemy machines to the "Centre of Warning," which in turn put the police in action and sounded syren warnings. Smoke was released to represent enemy gas bombs. The police, wearing gas masks, warned the medical services and gave first-aid to the gassed and injured. A gas-proof cellar was improvised, the walls being coated with chloride of lime to absorb gases; this improvisation took two hours.

Finally, an air attack was made on the barracks of an automobile service, the workshop representing a factory and the surrounding quarters representing tenement houses. The purpose of this part of the exercise was to test whether the system of sending warning to the district was satisfactory, as also the means of warning inside the area. The factory first-aid and fire squads were also tested. Warning was sent to the factory that a raid might be expected in thirty minutes; an alarm was sounded on a high part of the factory; men not detailed for duty and families from the neighbouring quarters hurried to the underground shelters to which they had been allotted. Inside the factory there were luminous signals, rotating parabolic lamps, which sent powerful beams round the rooms so if, on account of noise of machinery, a man had not heard the sound signal he would see the warning light. Foremen and managers saw that all men had left the factory and that all machinery had stopped working.

Gas bombs, represented by smoking material, were dropped in the courtyard of the factory, and the carpenters' and paint shops were presumed to have been set on fire. The factory fire brigade took action and the town fire brigade was summoned. Demonstrations were given with carbonic-acid apparatus and with foam extinguishers.

Finally, a gas-bomb attack was made on workmen's houses, and the Red Cross and Technical Help Services were summoned; these gave a demonstration of dealing with gas casualties and with gas-contaminated material.

The extractor of the original paper concludes by saying that the report throws a vivid light on the serious question of the protection of civilians against attack from the air, and that the practical importance of the organization of civil defence is evident.

Lightening the Weight of the Pack, Steel Helmet and Entrenching Tools. *Militär Wochenblatt*, 1931, No. 38, p. 1490.

The writer says that for some time there has been a desire to lessen the load carried by the soldier (German), which, after the war, rose to fifty-eight pounds. The increase over the pre-war weight was due to the steel helmet, gas mask and long entrenching tools.

The weight has been reduced to fifty-one and three-quarter pounds, and the reduction has been made as follows :—

A rucksack has replaced the haversack. Reduction had been made in the weight of the laced shoes, which in any case were useless for marching. The weight of the bread sack has been reduced by a few grammes. A new field flask with an attached drinking cup has been provided. The number of cartridges carried by the man has been reduced—this might be dangerous. Washing kit and drill clothing are placed in a new valise which is carried in the baggage train.

The writer goes on to consider whether further reductions can be made. He thinks the weight of the gas mask and filter cannot be reduced. He has a great deal to say against the steel helmet, and, although he admits that it has many advantages, there are many against it, and he wonders if it is necessary in a war of movement. Some of the objections to the helmet are: it is uncomfortable to wear; it has a metallic shine; it obstructs the hearing, which is a disadvantage for men on patrol and for telephonists; it interferes with the wearing of gas masks. The writer states that although the helmet gave protection against splinters, and so was useful in position warfare, it gave very poor protection against bullets which frequently pierced the helmet, and on account of its being split up, the bullet inflicted large and usually fatal wounds. The writer thinks a light shako might be substituted for the steel helmet.

Objection is made to the entrenching tools which are considered to be too heavy and too long. The spade weighs 1,900 grammes and the pick-axe 2,500 grammes. They are so long that a man cannot dig himself in while lying on the ground, but has to stand up and so unduly expose himself.

United States Public Health Service—Studies on Raw Water Pre-Chlorination.

The results of studies on raw water pre-chlorination have recently been made public by the U.S. Public Health Service. The conclusions drawn from the report are briefly as follows :—

Raw water pre-chlorination, when properly controlled, affords an effective and economical means of reinforcing the bacterial efficiency of rapid sand

water filtration processes, these experiments having indicated that the permissible density of *Bacillus coli* in the raw water could be slightly more than doubled by the use of this measure.

Maintenance of a controlled low residual chlorine in the applied water, averaging 0·05 part per million and not exceeding 0·10 part per million, gave more consistent and, in general, more satisfactory results than did super-chlorination, with a high residual chlorine.

The bacterial efficiencies of filtration and of post-chlorination appear, from these observations, to be measurably reduced as the result of pre-chlorination.

Although the length of filter run was not increased by pre-chlorination under the conditions of these experiments, the development of growths of microscopic organisms was perceptibly retarded by this treatment.

The application of pre-chlorinated water to rapid sand filters appears to lower the bacterial content and the biochemical oxygen demand of the filtering medium. Variations in both of these elements were found to bear a fairly definite relation to concurrent variations in the residual chlorine of the applied water.

More general observations made in the course of the experiments confirmed the prevalent impression that it is advantageous to chlorinate before, rather than after preliminary sedimentation in order to utilize the stabilizing effect of basin treatment prior to applying pre-chlorinated water to filters. They also indicated, however, that even with the stabilizing influence of such basin treatment, careful technical supervision and laboratory control are necessary to maintain a relatively constant chlorine content of water applied to filters, which appears to be a desirable condition for consistently effective filtration. Although the ability of well-ripened filters to absorb excessive amounts of chlorine for considerable periods of time constitutes a valuable operating factor of safety, in so far as the production of over-chlorinated effluents is concerned any undue burdening of filters with excessively chlorinated water may be expected, as shown in these studies, to result in a measurable impairment of their bacterial efficiency.

The main advantage of pre-chlorination, from the view-point of this study, may be summed up as being its effectiveness and relative economy as a measure for reinforcing the over-all bacterial efficiency of the rapid sand filtration process, when considered as a whole. Its principal disadvantage appears to be its tendency to cause a perceptible decrease in the bacterial efficiency of filtration and of post-chlorination. From a practical standpoint, this disadvantage appears, from the study herein described, to be outweighed by the advantage above indicated, though it should be taken into account in casting up a balance sheet of performance to be expected in applying this method of treatment.

Reviews.

SEX AND DISEASE. By Robert V. Storer, M.R.C.S., L.R.C.P. London: John Bale, Sons and Danielsson, Ltd. 1931. Pp. 150. Price 4s. 6d.

This book has gone through three editions in Australia since 1929, and the publishers of this the fourth edition say that they decided to issue it in England in view of the good work that had been done by the previous editions in educating the people of Australia on venereal disease.

The aim of the author is to give the public a knowledge of sex physiology and of venereal diseases, with information on methods of avoiding these diseases, their treatment and the dangers of non-treatment or insufficient treatment.

In the earlier chapters, sex education and the anatomy and physiology of the genital organs of the male are discussed. Then come descriptions of the venereal diseases and statistics of their prevalence in various countries, especially in Australia.

Chapter VI is headed "Difficulties in Securing Proper Treatment," and the author states that on account of diffidence in consulting his own doctor the patient often falls into the hands of unscrupulous chemists or unscrupulous quacks, although there are various Venereal Diseases Acts in Australia, as in this country, under which these people may be dealt with. Then the author states that the patient usually goes to a Government clinic, where equipment is not in accordance with modern practice owing to the lack of funds, where there is understaffing, and where the patients do not receive the necessary attention. This statement may be accepted in the author's country, but it cannot be applied to the clinics the reviewer has seen in this country, where equipment and medical attention are satisfactory.

However, in a later chapter the author states that the marked reduction in the incidence of syphilis is largely due to the free and efficient clinic facilities, although he says that a similar reduction in gonorrhœa has not taken place, either owing to there being no specific remedy for that disease or owing to the inefficient staffs and equipment of the clinics.

For personal prophylaxis the author has apparently little belief in the condom and his objections to this generally-recommended appliance appear to be unduly exaggerated. The author states that he has evolved a protective cream, to which he has given a special name; but although this cream contains well-known prophylactics, the statement that if it be applied within two hours of exposure it will definitely prevent the development of syphilis, gonorrhœa and chancroid, is open to doubt and might lead to dangerous risks being taken.

Treatment of gonorrhœa and syphilis and the dangers of too early cessation of treatment are fully described.

A study of the more general paragraphs of this book will be of use to social workers, while the medical details of prophylaxis and treatment should readily convince prospective patients that the avoidance of venereal disease and of its evil results is not an easy task.

To Husbands and Fathers. Published by the Association of Maternity and Child Welfare Centres, Carnegie House, London, W.1. 1931. Pp. 31. Price 3d., post free.

This small book, written by six medical practitioners, begins by giving the husband some advice on being happy though married. He is advised not to tell his wife brutally to go and learn how to cook, but to suggest that a little outing twice a week, say to a cookery class, would make a nice little change which would let her meet other women; a danger of this, however, might be that she would see that other women were just as bad cooks as she was.

The husband is advised to give way gracefully in matters of his wife's new clothes, as nothing he could say would make the woman change her mind, and he is encouraged to avoid differences in these matters. One would remark that there must be very few husbands who have had to read a book to find this out.

The question of family limitation is lightly touched on and an only child is not recommended.

There is a very useful chapter on the psychology of the pregnant woman, followed by advice on the sexual relations of the couple.

In a later chapter there are three pages of embryology, in which a few diagrams may help the husband to follow the descriptions given of the ovum and spermatozoon, while the pictures of the fœtus at various stages of its career will help him to believe in the Darwinian theory.

Venereal diseases are dealt with shortly and clearly in a manner admirable for lay reading.

The last chapter deals with sex education for boys.

The pamphlet can be recommended.

Rats and Mice as Enemies of Mankind. London. Printed by Order of the Trustees of the British Museum. Pp. x + 70, 2 plates and 6 text figs. Price 1s.

The pamphlet "Rats and Mice as Enemies of Mankind," British Museum (Natural History) Economic Series, No. 8, by M. A. C. Hinton, should be in the possession of every sanitary officer.

The pamphlet clearly differentiates between the varieties of rats and mice, illustrates their life histories and habits, and points out their dangers, both from the disease and economic points of view. With reference to rats, it is hardly realized that the black or so-called plague rat has

succeeded in re-establishing itself in many of the chief cities of Britain, and few of us grasp the enormous economic loss, estimated at £15,000,000 annually, due to the depredations of rodents generally.

The chapter on prevention and extermination is specially valuable. Information as to the best procedure to be adopted during "Rat Week" is in constant demand, and in this pamphlet the most recent work is available in an interesting form.

The pamphlet is well got up, clearly printed and illustrated, while the price is very moderate. N. L.

THE PHYSIOLOGY OF MUSCULAR EXERCISE. By the late F. A. Bainbridge, M.A., M.D., F.R.S. Third edition, re-written by Professors A. V. Bock and D. B. Dill. London: Longmans, Green and Co. 1931. Pp. viii+272, 46 diagrams. Price 15s. net.

This book was originally published in 1919; that a third edition has now appeared is proof of its popularity. It consists of 272 pages, which may appear to be rather many for such a subject, but, having regard to the methodical and exhaustive method in which the various factors bearing on the subject are dealt with, one realizes the book could not be made smaller without curtailment of vital material. Pages v to viii are taken up with Prefaces and list of Contents. The remainder of the volume is divided into twelve chapters, occupying 244 pages, together with a Bibliography of 22 and an Index of 6 pages. One is led from the sources of muscular energy, the mechanical efficiency of the body and the temperature of the body during exercise to the consideration of the physico-chemical changes in the blood and the control of respiration. Two chapters are devoted to the action of the heart and the influence which the pulse-rate has on it, and one to the blood-supply of the active organs and arterial pressure.

Next is considered the passage of oxygen to the tissues, the consumption of oxygen by the muscles and the consumption of oxygen by the heart; and then the chapter on co-ordination explains how all the various systems are influenced and controlled to produce that triumph of team work necessary for the maintainance of prolonged muscular exercise.

The chapter devoted to nature of diet, general effect of training, exercise in the trained and untrained man, etc., should be of much interest to military medical officers whose work must always have a large bearing on these subjects.

The effect of exercise on the various systems at high altitudes is also described.

The chapter on the after effects of exercise, the circulatory and respiratory changes and fatigue completes an exhaustive consideration of all the various factors which have to be considered in a work of this nature. The final chapter is devoted to the beneficial effect of exercise and a summary of the mechanisms involved, together with statistical records covering the longevity of athletes.

That the Bibliography should take up twenty-two pages is an indication of the thoroughness with which the subjects are discussed and of the ventilation afforded to the diverse views held by various authorities.

Physiology must always remain an imperfect science, but this book adds much to the knowledge of the physiology of muscular exercise.

THE VETERINARY BULLETIN. Published by the Imperial Bureau of Animal Health, Weybridge, Surrey, England.

The *Tropical Veterinary Bulletin*, formerly issued by the Bureau of Hygiene and Tropical Diseases, has on the recommendation of the Imperial Agricultural Research Conference, held in 1927, been merged in a new journal—*The Veterinary Bulletin*, published by the Imperial Bureau of Animal Health.

The new journal will deal with all aspects of animal health from the point of view of research and administrative control, but not with ordinary clinical cases. It will be issued quarterly during 1931 and monthly from January 1, 1932. The annual subscription is £1 or 7s. 6d. for single numbers.

No. 2 of vol. 1, which has been submitted for review, consists of ninety pages of extracts, chiefly from current veterinary literature, but also from journals of general bacteriology and pathology ; there are also summaries of veterinary work done in various colonies and protectorates.

This Bulletin will be found useful by Army medical officers and especially by bacteriologists and hygienists.

Notice.

CHADWICK LECTURES.

A Chadwick Lecture in London will be given at the Institution of Mechanical Engineers on December 3. Mr. J. D. Watson, M.Inst.C.E., of Birmingham, will speak of "The Need for More Effective Treatment of Sewage Sludge."

Aided by his lantern-slides, Mr. Watson will describe the ordinary smell-producing methods of dealing with sludge (now being abandoned), and the systematic digestion and air-drying processes already established or being introduced.

Sir George Humphreys will be in the chair.

Among other Lectures in Metropolitan and Provincial Centres arranged for the Autumn and coming Spring will be "The Outlook on Tuberculosis—Now and Then," by Sir Robert Philip at Gateshead, on November 13, and "Benjamin Ward Richardson—His Life and Work," by Dr. J. D. Rolleston at the Medical Society of London on February 18, 1932.

Further information as to Chadwick Lectures may be obtained from the Secretary, Mrs. Aubrey Richardson, at the Offices of the Trust, 204, Abbey House, Westminster.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

List of Books Received during the Period July 1 to September 30, 1931.

Author(s)	Title of Work	Grant or Gift
Arvedson	Medical Gymnastics and Massage in General Practice	Grant
,, ...	The Technique and Uses of Sewdish Medical Gymnastics and Massage	,,
Hale-White (Douthwaite)	Materia Medica	,,
Jellett & Tottenham ..	A Short Practice of Gynæcology	,,
Eden & Holland.. ..	A Manual of Midwifery..	,,
Jellett	A Short Practice of Midwifery..	,,
Piney	Recent Advances in Hæmatology	,,
Kirk	Public Health in the Tropics	,,
Culpin	Recent Advances in Psychoneuroses	,,
Thresh & Beale	A Simple Method of Water Analysis	,,
U.S.A. War Dept. (Love)	War Casualties: their Relation to Medical Service and Replacements	U.S.A. War Department
Wilkes & Bettany ..	A Biographical History of Guy's Hospital ..	Major S. H. Woods
Crawford	Roll of Indian Medical Service. 1615-1930..	Grant
Leeson	Anopheline Mosquitoes in Southern India. 1926-1928	Major Heatly-Spencer
War Office (Mitchell) ..	History of the Great War. Medical Services. Statistics.	War Office. C. 2c.
Dunham	Military Preventive Medicine	Grant
Storer	Sex and Disease: A Contribution to National Health	Library and Journal Committee
Bennett	The Practical Treatment of Diabetes.. ..	Director-General
Sykes	Anæsthesia	Grant
Medical Research Council	A System of Bacteriology. Vol. ix	,,
Neblette	Photography	,,
Hutry & Marek	Pathology and Therapeutic Diseases of Domestic Animals. 3 vols.	,,
Mitchell	Building Construction. 2 vols.	,,
Whiting	Aids to Medical Diagnosis	,,
Wright	Applied Physiology	,,
Economo	Encephalitis Lethargica	,,
Bainbridge (Bock & Dill)	Physiology of Muscular Exercise	,,
Greig	Surgical Pathology of Bone	,,
Frank	Gynæcological and Obstetrical Pathology ..	,,
Holmes & Ruggles ..	Roentgen Interpretation	,,
Boyd	The Pathology of the Internal Diseases ..	,,
Jordan	Food Poisoning and Food-borne Infections ..	,,
Lees	Venereal Diseases	,,

CORRIGENDA.

In the paper "Some Investigations into So-called 'Non-Agglutinable' Dysentery Bacilli," by Major J. S. K. Boyd, in the September, 1931, number of the Journal, the following corrections should be made:—

Page 163, for references "[5]" and "[4 and 6]" read "[3]" and "[4, 5 and 6]" respectively.

Page 165, line 2, for "one of the two" substitute "nor one of the other two".

Page 183, line 11, for "C" read "O".

Page 183, line 14, for "B" read "S".

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—" The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C. 2.

VOL. LVII DECEMBER 1931. No. 6.

Journal

of the

Royal Army Medical Corps.

Original Communications.

AMBULANCE TRANSPORT IN UNDEVELOPED COUNTRIES.[1]

BY MAJOR-GENERAL P. H. HENDERSON, D.S.O.

IT was the intention of the late Major N. V. Lothian and myself to write a full history of the ambulance transport employed in all the theatres of the Great War, as regards both the means of transport and its organization, but Major Lothian's lamented death in Palestine and stress of work on my own part have prevented the fulfilment of this hope.

It will perhaps be most interesting if I select a definite campaign of the Great War waged in an undeveloped country, and describe the ambulance units as they arrived there equipped only for service in countries in which roads and railways were highly developed and how suitable transport was evolved for these units. I shall therefore select the campaign in Macedonia and when I come to deal in detail with individual types of transport I shall indicate other theatres in which they were employed during the War.

The greater part of the Macedonian Force landed at Salonika towards the end of 1915, the 10th Division being the first British Division to arrive from Gallipoli, in October; this was followed by five other British Divisions and a mounted brigade from the Western Front. The field ambulances of these Divisions were not equipped with pack transport but brought with them only the motor ambulance cars and horsed ambulance wagons which had been in use in France. It was therefore a surprise to find on our arrival that, so far as the British zone was concerned, there were only three main roads and these in so bad a state that they would quickly

[1] A paper read before the United Services Section of the Royal Society of Medicine on April 13, 1931, and reprinted by kind permission.

break up any motor ambulance car and be a source of the greatest discomfort to any wounded transported in such vehicles. Over the larger part of the area occupied by the Divisions there were no roads but merely rough mountain tracks made mostly by goats and sheep; on these neither ambulance cars nor wagons could be used. The only railway near our zone was on the left flank and in the early stages of the campaign was of no use for the evacuation of our casualties (see "Official History of the War, Medical Services, General History," Vol. iv, sketch map facing p. 75, showing medical arrangements for collection and evacuation of sick and wounded, Salonika, February, 1916). Such a situation in regard to ambulance transport can only have arisen through lack of knowledge of the nature of the country by those responsible for despatching the divisional medical units, and I therefore stress the importance of having a medical branch of the intelligence section of the General Staff responsible for collecting all information which might affect the organization and administration of the medical services in possible theatres of war.

In Macedonia luck favoured us. After the 10th and the two French Divisions withdrew from the Serbo-Bulgarian frontier and we took up a defensive position on the Lembet hills surrounding Salonika, we were unmolested by the enemy, except from the air, until the summer of 1916, and therefore had ample time to improvise suitable forms of ambulance transport and to experiment during exercises with troops on the hills which we held.

The Director of Medical Services of the Salonika Force quickly grasped the situation and invited all medical units, particularly of Divisions, to improvise suitable ambulance transport, and an exhibition and demonstration of the various devices was eventually held in January, 1916. Many interesting and ingenious types of transport were produced, and from these, in February, 1916, the Director of Medical Services drew up a provisional scale of transport suitable for a field ambulance--(*a*) partly on wheels and partly pack, and (*b*) wholly pack, as follows:—

(*a*) *Combined wheels and pack.*

3 motor ambulance cars.
3 light-horsed ambulance wagons.
60 mules with cacolets.
60 mules with litters and travois.
6 mules with two-wheeled stretcher carriers.
12 man-handled mono-wheeled stretcher carriers.
86 ambulance stretchers (including a reserve of 50).

(*b*) *Wholly pack.*

27 mules with universal riding saddles.
60 mules with cacolets.
15 mules with travois.
6 mules with litters.
6 mules with two-wheeled stretcher carriers.
5 spare mules.
74 ambulance stretchers (including a reserve of 50).

These provisional establishments were modified from time to time, particularly in regard to cacolets and travois, as experience was gained in the use and in the construction of the different types of transport and also in order to meet the

differences in the terrain, which was hilly in some Divisional areas and flat or undulating in others, but without pucka roads and apt to be swampy. A.Ds.M.S. of Divisions were therefore given considerable latitude and used their discretion as to the proportions of the different types of improvised transport to be employed in their respective areas, for success in evacuating casualties depended on having a sufficiency of types of transport capable of being used efficiently on the prevailing routes of evacuation.

When we moved forward from the Lembet hills in the Salonika hinterland, to the line extending from the Vardar to the mouth of the Struma, each field ambulance was allotted, in addition to the improvised ambulance transport, ten light ambulance wagons, but as there were many situations in which these could not be used, they were held as a divisional reserve and issued to units when necessary. During battles ambulance cars were allotted by Corps to Divisions when the latter were in positions where they could use them.

From the end of 1916 to the close of the campaign in 1918, the British Army front extended from the mouth of the Struma River at Stavros Bay to the Vardar River—approximately 90 miles. For part of this time we had six Divisions, but on the transfer of the 10th and 60th Divisions to Palestine, only four Divisions and the 228th Brigade were left. The 27th Division, of which I was Assistant Director of Medical Services, held for the greater part of the time a frontage of approximately 35 miles, extending from the mouth of the Struma to Orljak Bridge on the Salonika-Seres road—a vast frontage compared with that held by a Division in France (see sketch map showing scheme of evacuation from XVIth Corps, Sept., 1917, summer positions, "Official History of the War, Medical Services, General History," Vol. iv, p. 139).

Before the final offensive, the 27th Division took over a sector west of the Vardar, which was hilly country with few roads, and successfully fought the first battle in the operations which brought about the final victory over the Bulgars (see map of medical situation, Doiran front at time of final operations, "Official History of the War, Medical Services, General History," Vol. iv, facing p. 144).

I will now describe the different forms of transport employed:—

I.—Carriage by Man.

(1) *Hand-carriage without apparatus (pick-a-back, etc.).*—This method was not extensively used as the voluntary assistance of unwounded men was not merely discouraged but forbidden and actually punished. It affords, however, a means of bringing back casualties from difficult positions (e.g., Indian Frontier picquets), which is not to be neglected, especially when prisoners are available, or when stretchers cannot be used or have run short. R.A.M.C. Training deals at some length with different methods under this heading, and I will not take up time by describing them.

(2) *Hand-carriage with apparatus.*—(i) By stretchers. As these are the most important part of the apparatus for transport of casualties I will emphasize one or two points in regard to them:—

(*a*) During the late war various special types of stretchers were devised which doubtless served a useful purpose during trench warfare. They can, however, never replace the standard Mark II stretcher and it is essential for general purposes that

there should be but the *one* standard pattern of stretcher which will fit accurately on to or into all the various contrivances used for transporting casualties.

(*b*) The vital importance of an adequate supply of these stretchers, not only in the country where operations are taking place but also conveniently situated to Divisions and with ample arrangements for transporting them to R.A.P.'s and A.D.S.'s.

(*c*) The necessity for a sufficient number of contrivances for adjustment to stretchers to enable suitable cases to be carried in the Fowler position or with head and chest or leg raised. For the last, iron suspension bars fit on to the stretcher and to these Thomas's splints were attached.[1] For the Fowler position or raising the head and chest we improvised in Macedonia very simple contraptions of wood and canvas, which are easily understood from a study of fig. 1. The lower portion is kept in position solely by the patient's knees, and the support for the chest by a strap fastened round the stretcher.

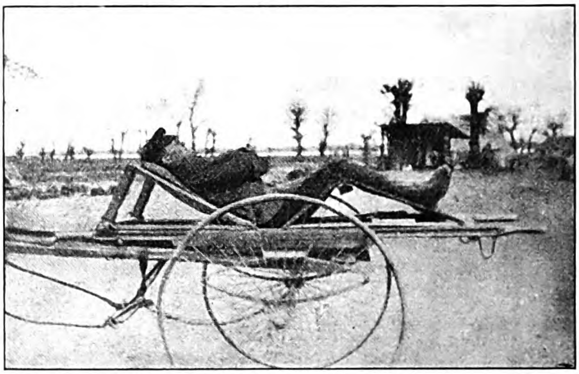


FIG. 1.—Patient in Fowler position on improvised back and knee rest.

(ii) By dhooly.—This was the favourite method of transport in India some years ago, and was much used on the N.W. Frontier for long carries, but has now been replaced by a stretcher carried on the shoulders. There are occasions, however, when narrow and precipitous paths render carriage by two bearers impracticable. One must then adopt the dhooly—its swaying motion is, however, not pleasant.

A simple pattern consists of a 15 ft. pole from which the stretcher is suspended by its slings. The pole is supported by cross bars set at such an angle as to permit four bearers to walk virtually in file.

II.—Transport drawn by man or animals.

The two-wheeled stretcher carrier.—In the early stages of the war this, in the form of the carriage, ambulance stretcher, Mark I, was used chiefly, if not solely, in hospitals. A number of different varieties of this carriage were used later, the best known being the Brook-MacCormack, the Furber and the Miller-James, and, while they all served their purpose, the one that proved most useful for the

[1] See figure, "Suspension apparatus for fracture cases of lower extremity," "Official History of the War, Medical Services, General History," Vol. iv, p. 563.

evacuation of casualties across country was the Brook-MacCormack, chiefly because the other two varieties had pneumatic tyres which burst or punctured. Repair outfits were not usually available when wanted, and even if procurable, it was not easy or pleasant to mend a tyre under fire, possibly in the dusk and in a quagmire.

The Brook-MacCormack, i.e., the official "Carriage, ambulance stretcher, Mark I," proved most useful and comfortable, and was used extensively in Macedonia, South Russia and elsewhere. Each field ambulance in Macedonia had an official allotment of six Brook-MacCormack stretcher carriages and six mules for drawing them, and a number of regimental medical officers improvised similar contrivances to which they harnessed small ponies or donkeys, which were fairly easy to procure and which fed themselves on the country (fig. 2). These carriages are provided with struts to prevent the stretcher from tipping over when the carriage is at rest or when being unloaded. The wheeled stretcher carrier has the following advantages:—

FIG. 2.—Mule harnessed to carriage, ambulance stretcher, Mark I.

(*a*) It is comfortable either in hills or in valleys where narrow paths, unsuitable for ambulance cars or wagons, exist. It can also be used with comfort in undulating pathless country when the surface is not rough.

(*b*) When man-handled it saves man power, as once loaded one man can push or pull it with ease.

(*c*) It economizes energy expenditure, a factor of importance not always appreciated by military commanders. In saving energy it also diminishes the risk of heat stroke or heat exhaustion amongst stretcher-bearers.

(*d*) If the distances to be covered are not too great, man-handling is all that is necessary, so that it saves time in harnessing up animal transport.

(*e*) It is easily adaptable to mule or pony draught by fitting it with ash shafts, $2\frac{1}{2}$ in. by 2 in. thick and curved outwards at the ends. These shafts are also convenient for man-handling. As these carriages were chiefly used in war theatres where pack saddlery was at hand, the common method of harnessing was to combine breast-strap draught with suspension by tugs. Some units preferred improvised wooden swingle-trees and ordinary draught harness.

While one muleteer and one R.A.M.C. orderly are necessary for a single carriage on the move, one orderly can look after a number of carriages when in convoy.

(*f*) When mule or pony drawn, these carriages can move at three miles an hour across country.

(*g*) It is easy by means of iron-tibbin bands, canvas and mosquito netting to improvise covers and thus provide protection against the elements and mosquitoes during transit on such carriages (fig. 3).

Disadvantages of the wheeled stretcher-carrier are :—

(*a*) It cannot be used over very rough country or in deep mud.

(*b*) It cannot be used with mules, close to the enemy in zones of active enemy action.

The mono-wheel stretcher carrier.—Various types of mono-wheel stretcher carriers were devised, mostly from old cycle or motor-cycle wheels. These were useful in economizing energy and personnel in France when employed in evacuation

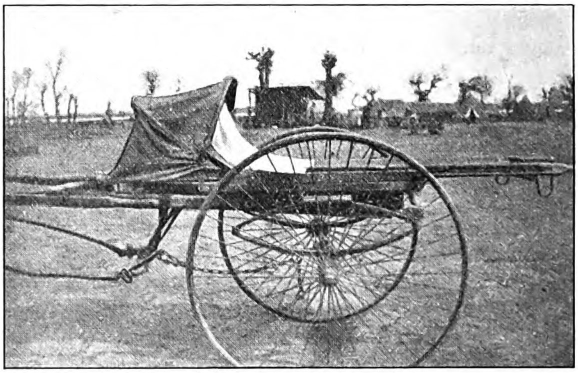


FIG. 3.—Showing sunshade with mosquito curtain attached to stretcher. Sunshade is collapsible and is made from old tibbin bands and bivouac sheets.

trenches, against the walls of which they could be supported when at rest, but, they had disadvantages for use in open country where they were difficult to balance when loaded and very apt to skid, particularly on the sloping mud tracks in Macedonia.

The fact that the Director of Medical Services, Salonika Force, included twelve in the transport of each Field Ambulance was due to the efficient way in which these contrivances were demonstrated at the exhibition already referred to, and as the result of an over-optimistic report rendered to the D.M.S. by a Field Ambulance Commander.

Skis.—Although I have had no experience in war of the use of skis for ambulance transport, I have used them in peace time for the transport of injured in snow, and they were commonly used in the war by the French and Poles.

Carrying a stretcher, they provide a very comfortable and easily pulled contrivance in countries under snow. Figs. 4 and 5 show two suitable designs.

III.—Animal transport.

(*A*) *Wheel-less animal transport.*

(1) Riding animals.—Lightly wounded cavalry may proceed on their own mounts to a dressing station, but apart from this it was found necessary in Macedonia to make a definite allotment of twenty-seven mules, with universal riding saddles, to each field

ambulance working on a pack basis, and these proved most useful in bringing in lightly wounded.

In hilly country and in valleys where mud was deep and long distances had to be covered, A.Ds.M.S. of Divisions often found it advisable to discard the cacolets in all their field ambulances and use the cacolet mules as riders for bringing in wounded. I will refer to this later. Equipped with universal riding saddles and one mule in four with a pack-saddle for kit, these mules ensured the rapid evacuation of numbers of lightly wounded men in convoy who would otherwise straggle back irregularly and under no supervision. One muleteer can take three loaded animals linked in series and one R.A.M.C. orderly proved sufficient to accompany a convoy of such cases.

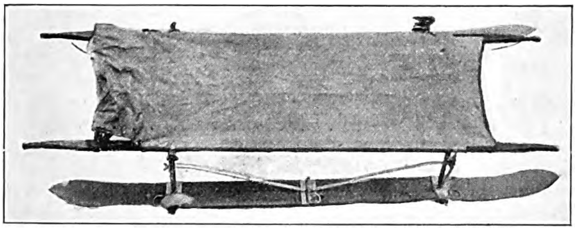


FIG. 4.

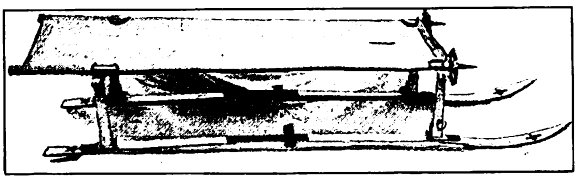


FIG. 5.

FIGS. 4 and 5.—Skis used for ambulance transport. (Reproduced by kind permission of the "Institut international d'études de matériel sanitaire," Geneva.)

Riding mules and ponies are also a recognized form of transport on the Indian frontier in situations where there are no roads, and were used in Waziristan in 1919-20, where there was a L. of C. eighty miles long, quite unfitted for wheeled transport.

(2) Animals bearing cacolets and other carrying devices.—In certain theatres of operations in the Great War where wheeled transport was impracticable, efforts were made to utilize animals carrying sitting and lying cases. In Macedonia, at the exhibition of improvised transport, in January, 1916, various devices were tested, particularly two large panniers slung on the sides of a pack mule to support a stretcher athwart the saddle. The expenditure of considerable ingenuity in the construction of light brackets and in the balancing and fixing of the loaded stretcher showed that over short distances such a method of transport was quite possible, but the anxiety of the patient precariously perched on the mule, the sway and tendency to slip, and the risk of the stretcher being caught among trees, led to the abandonment of the idea. Equally unsatisfactory were other devices, such as attempts to support the stretcher

lengthwise along the back of the mule. The only feasible means involves bilateral suspension, thus lowering the centre of gravity and providing balance.[1] The French have long used such apparatus both for lying and for sitting cases.

The cacolet was adopted when the going was suitable as the principal means of evacuating sitting cases in Macedonia, sixty mules, each carrying two cacolets, being the establishment for a field ambulance, whether on wheels or pack. The cacolet was also used in Palestine, Russia and elsewhere.

The cacolets are fixed to the ordinary mule pack-saddle and are skeleton apparatus which unfolds to form a seat with foot rest on each side of the mule, the seat facing the mule's head. Both cacolets must be occupied to give balance. Each mule requires a muleteer, but one R.A.M.C. orderly suffices for five loaded mules. The motion is not unpleasant, but the strain on the mule is great and a special type of mule is required for success. A suitable mule will carry two 10 st. men, without kits, for five miles across fairly level country. A kit mule is required for every three loaded animals. In organizing cacolet convoys relay teams every five miles are essential. On steep hill tracks and in deep glutinous mud the mules proved unequal to the work. In such situations we stored the cacolets and converted the mules to riders thus halving the carrying capacity for sitting cases.

The mule litter and travois.—A contrivance was evolved and selected as the standard pattern in Macedonia which served either of these purposes and was designated a "litter travois". Of all the apparatus used in the War for the transpórt of casualties, excepting only motor ambulance cars, the litter, the travois, and finally the combined litter-travois showed, perhaps, the most remarkable development. Our Army training manuals devoted but a few brief paragraphs to these devices, nevertheless, the extent of their use in various theatres of war (Macedonia, Palestine, Russia, etc.), their remarkable convenience and their ability to convey casualties in comfort along narrow tracks winding through hills and ravines, over broken stony ground, and through deep mud, all characteristic of the Salonika hinterland and over which ordinary wheeled transport could not be used, and over much of which even the modern six-wheeler or caterpillar would be useless, render it imperative that they should not be overlooked as valuable forms of ambulance transport in undeveloped countries, and I trust that this paper may at least prove useful as a record of these particular forms of transport.

I do not know when litters were first devised but I understand that travois were first used by the North American Indians who, in moving camp, used the tent poles as travois on which they carried their tents and baggage and on which they themselves rode. A mule-litter is a contrivance carried between two mules, while a travois is similarly constructed, harnessed to a mule in front but with the rear ends of the poles dragging along the ground. (Figs. 6 and 7.)

During the War the early patterns of litter and travois devised were similar to those figured in R.A.M.C. Training and were made from young trees and other local material. Later, bamboo types were tested but proved too fragile, perhaps owing to the issue of bamboo of inferior quality or the wrong kind. Tube iron structures were then adopted and though durable and reliable were too heavy. Finally, after all the varieties and patterns had been thoroughly tested and considered, a standard

[1] "Official History of the War, Medical Services, General History," Vol. iv, figs. on pp. 595-6.

type made of stout ash was selected. The parts were supplied by Ordnance and were assembled by the field ambulance personnel. The final scale per field ambulance was forty; they could be used either as litters or travois and were therefore known as litter-travois. For these the allotment of mules was sixty per field ambulance, and as two mules were required per litter, and only one per travois operating over fairly easy undulating ground, they could be employed, twenty as litters and twenty

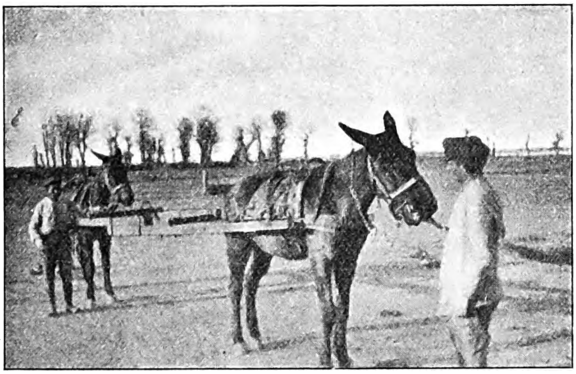


FIG. 6.—Shows litter harnessed up. Litter is the correct length of 19 ft., but is the present cumbersome pattern composed of two long poles on each side.

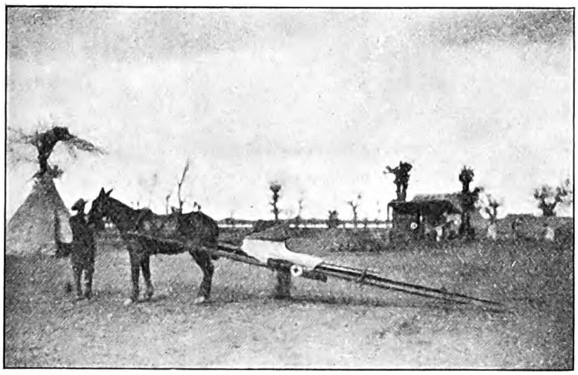
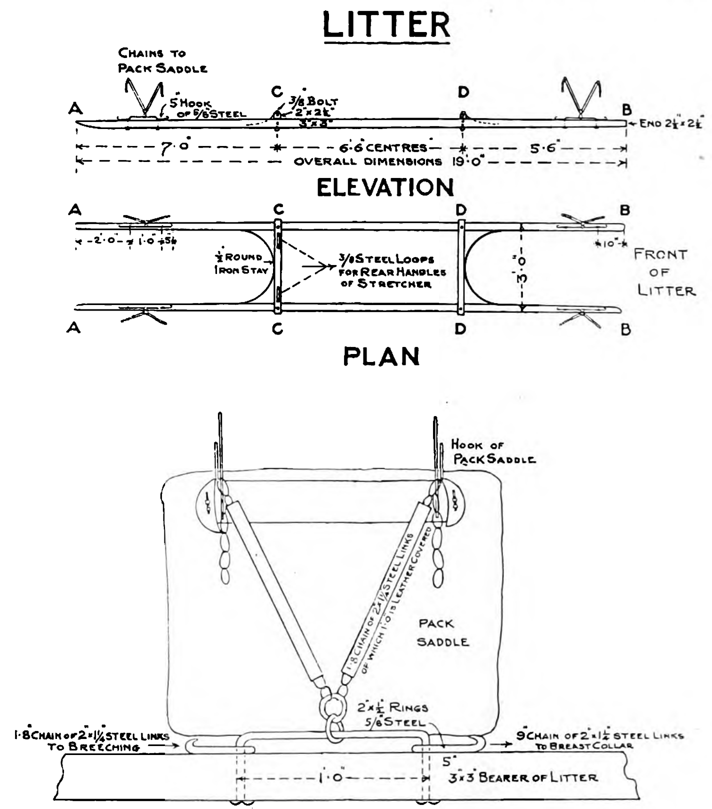


FIG. 7.—Shows the 19 ft. litter being used as a travois, and also shows sunshade and mosquito net on stretcher.

as travois, but, as the manner of their use depended on local terrain this was left to the discretion of Divisional A.Ds.M.S. or field ambulance commanders.

The factors in the construction of the litter-travois which greatly affect the comfort and utility of this apparatus are as follows: To be efficient a litter must be simple, light but strong, as short as practicable, easy to harness and capable of rapid release. In the type finally adopted in Macedonia each bearer-pole consisted of two halves joined by steel bands and bolts. This entailed assembling the parts at the field ambulances. The junction is a source of weakness, and, where the ends overlap, there is unnecessary thickness and weight at a point where there is no excessive

strain. With the assistance of an R.E. officer I worked out the reactions at different parts of the apparatus when fully loaded as a litter and as a travois. As a result I strongly advocated, and still recommend single ash poles 19 ft. × 3 in. × 3 in., tapered to 2½ in. × 2½ in. at the ends from points 5½ ft. (front) and 7 ft. (rear) from the ends (fig. 8). If bamboo is used, it must be male bamboo and must not be worm-eaten, sun-dried or cracked. The ends should be rounded off on the inside to avoid cutting the mules and the front ends slightly bent outwards like the shafts of a dog-cart.



DETAIL OF ATTACHMENT TO PACK SADDLE

FIG. 8.

Such single poles when loaded with a stretcher carrying a man of average weight and his kit (i.e., 248 lbs.) have a factor of safety of 5 with a dead load and 2½ with a live load and vibration, which is ample.

The cross bars which support the stretcher should be of the same material as the poles, 2½ in. × 2½ in., and are secured to the bearer poles by ⅜ in. steel bolts. Two loops of ⅜ in. steel are bolted through the rear cross bar, and under these the rear handles of the stretcher are passed in order to keep it securely in position. They are not required on the front cross bar, as the stretcher runners abut closely against it. Two ½ in. round steel stays are required between the lateral poles, just

beyond the cross bars; these stays keep the litter steady and prevent those lateral and swaying movements which tended to make the first devised litters uncomfortable conveyances for wounded.

A $\frac{5}{8}$ in. steel bar 1 ft. long is bolted through the shafts; this bar carries the chains by which the litter is suspended to the pack-saddle and at both ends of it are $\frac{5}{8}$ in. movable steel hooks to which the breast-collar and breeching-chains are attached when the mules are inspanned. The suspension chains should be leather-covered to the extent of one foot to prevent destruction of the pack-saddle by friction; the uncovered links enable the litter to be adjusted and the stretcher kept level on steep inclines. The ring which secures these chains to the bar and the bar itself should be kept well greased to enable free play to take place along the bar.

The chains from the breast-collar and breeching—which act as the traces—should be leather-covered half way from breast-collar and breeching to prevent chafing of mules.

Steel runners 15 in. long by $\frac{1}{4}$ in. thick may be fitted to the ends of the rear shafts to protect the wood should the litter be used as a travois. Wooden runners can also be easily improvised and secured in position by tibbin bands and these were preferred by many. It is essential that the upper ends of these runners should be flush with—and should not project from—the under surface of the poles to which they are attached, otherwise they are liable to pick up and cut ground telephone wires. A swingle tree attached to the front cross bar is essential to prevent lateral movement which is so uncomfortable to a patient.

When transporting wounded on travois over uneven country, it lessens shock if the rear end of one of the travois poles is 18 in. shorter than the other. This difference in length enables the ends to glide more easily and smoothly over bumps, thus avoiding sudden jars. A travois so made cannot be interchanged for use as a litter. The most suitable length for a travois is about 16 ft., and while it is possible to use a 16 foot litter, 19 ft. is a more suitable length.

To protect patients from weather and insect pests, covers are required for litters and travois. A suitable cover is made of canvas or ground sheet material fitted over a wooden frame or one made of tibbin bands.[1] The stretcher on a litter is naturally horizontal on level ground and on steep inclines can be kept level by lengthening the front suspension chains of the litter.

With travois it may be necessary to suspend the front handles of the stretcher in leather or rope loops under the anterior cross bar, but, with the 19 ft. travois this is not usually necessary.

The litter load per mule is roughly 200 lb., made up as follows: Litter 60 lb. (approximate), two pack-saddles 106 lb., stretcher 30 lb., man 154 lb., and man's kit 50 lb.; total 400 lb. With the correct type of mule this load, although heavy, can be successfully carried over long distances as the mules have a rest when returning with the empty litter.

The following views as to the advantages and disadvantages of litters and travois in undeveloped countries are my own and are based on four years of close observation and tests of these contrivances in the Balkans and Russia; my preference for the

---

[1] "Official History of the War, Medical Services, General History," Vol. iv, figs. on pp. 592, 593, 594.

litter over the travois is shared by other officers who had much experience of these forms of transport in Palestine.

(1) A travois used over level or slightly undulating grass land is as comfortable as, perhaps more comfortable than, a litter and can proceed at $2\frac{1}{2}$ miles an hour.

(2) Over level or undulating country a travois requires only one mule and one driver, whereas a litter requires two of each. Under such conditions travois show a marked saving in men and animals over litters and with an equal number of men and animals have a double carrying capacity.

(3) With the above exceptions, which are limited to special conditions of ground and country, I consider the litter much superior to the travois for the following reasons :—

(*a*) The litter is undoubtedly the most comfortable form of transport over rough or hilly country, lacking in roads, and covers on an average three miles an hour.

(*b*) The loaded weight, 400 lb., being shared by two mules never proves excessive.

(*c*) The litter is virtually independent of the nature of the ground ; wherever mules can find foothold there a litter can go. Mud and dust make little difference. Slopes are easily taken by two mules and there is no real difficulty at corners with a driver to each mule.

(*d*) Telephonic or telegraphic communications are not affected.

Disadvantages of travois.—The main disadvantages are :—

(*a*) They cannot be used in hilly country or where there is much undergrowth, nor can they be used on the sides of hills because of the lateral slope given to the stretcher and the resulting discomfort to the patient and difficulty in keeping him on the stretcher.

(*b*) On steep inclines two mules are essential and hence there is no saving, as compared with litters, in animals or drivers.

(*c*) On dry and dusty surfaces the patient is covered with dust stirred up by the runners.

(*d*) They interfere with communications by picking up and cutting ground telephone and telegraph wires. This risk is particularly great in the dusk or when it is dark.

(*e*) Unless wide wooden runners are supplied they cannot be used in deep mud.

(*f*) Over rough stony ground they jolt even when one pole is longer than the other.

(*g*) They are very difficult to steer on sharp curves in steep gullies as the mules tend to plunge up the steep bank and the travois is swung straight across instead of round the corner, with much consequent danger to the patient. To prevent this a drag rope with a man holding on to it is essential.

(*h*) The steel runners, except when used on soft and fairly flat surfaces, quickly wear out.

(*i*) Without a swingle-tree attached to the front cross-bar an unpleasant lateral movement is experienced by the patient.

Ambulance transport drawn or carried by camels.—In Palestine camels were used for cacolets, travois and litters.[1] The camel cacolets were of two kinds, one similar to the mule pattern and the other resembling a cot instead of a chair. The travois and litters were of bamboo and longer than the mule patterns; they were not provided with the devices used in Macedonia to prevent lateral motion, etc.

Kujawahs[2] are hammock-like contrivances carried lengthwise on either side of a camel. They were used in Palestine during the War and have for many years formed the principal method of ambulance transport for lying cases on the Indian Frontier where the lack of roads in many places renders normal modern ambulance transport unsuitable. In Waziristan, in 1919-20, a large force entered

---

[1] "Official History of the War, Medical Services, General History," Vol. iv, figs. on pp. 598, 599, 600.

[2] *Ibid.*, Vol. iv, figs. on pp. 601, 602.

the country and there was a line of communication some eighty miles long unfitted for wheeled transport of any kind. Casualties were evacuated by hand-carriage, riding ponies and mules and camel kujawahs, the great bulk being evacuated by kujawahs (in India there are also special bearer units, 500 strong, and hand-carriage by these bearers was used for the most severe cases). The kujawah is not ideal for transporting casualties; one G.O.C. reporting on it in 1919 described it as "still in use in India although barbarous and out of date, having been condemned by Field-Marshal Joshua at the battle of Jericho!" Nevertheless, after carefully considering the local conditions he had no alternative to suggest!

The chief objections to the kujawahs are that the paces of a camel are uncomfortable and with the harness in common use it is hard to ensure that the kujawahs keep level or do not fall off. Kujawahs are suspended from hooks attached to a frame which fits over the saddle or "palan." As these hooks are easily broken off a strap is commonly passed over the kujawah and under the camel to make the kujawah more secure. The saddle on which the frame rests keeps in position because it fits the camel's hump, the only girth is a rope. With kujawahs the patient is much inconvenienced when the camel kneels for loading or unloading. This can, however, be overcome by having platforms built at staging sections at C.C.S's. to enable loading and unloading to be done with the camel standing. These platforms are built in duplicate with a space between them sufficient to allow the camel to pass. The platform must be high enough, 4 ft. 3 in., to make loading easy by resting the kujawah frame on the platform with the camel standing, and the steps must be wide to facilitate taking the stretcher up to and down from the platform, which is 4 ft. 6 in. wide and 8 ft. 6 in. long. The camels are rather shy of these platforms until they get used to them. The maximum camel load is 400 lb., so a camel must be considerably overloaded when carrying two men of 11 st. each with their kit and the kujawahs.

Other forms of wheel-less animal drawn transport—sledges—have a definite value where snow or even mud militates against the use of wheeled vehicles. In campaigns in the far north either dogs or reindeer are used as the motive power, but where snow is not continuous these animals are not likely to be available and the ever useful mule usually provides the traction. During the War sledges were chiefly used for ambulance transport in North and South Russia. For certain mountain positions in the Caucasus I found them to be the only practical means of transport. Where dogs (fig. 9) are used in the snow, as in North Russia, light skeleton sledges are adopted, but when using mules and especially in mud, a stouter form of sledge is desirable. It has a swingle-tree fixed to one end for harnessing to the mule, which is provided with a kicking-strap and is guided by ropes from the rear. One muleteer and one orderly are required. Sledges are not practicable on very steep or sloping tracks with sudden bends. Over flat country however they may frequently be linked in pairs or they may be trailed behind other draught apparatus to carry kits.[1]

(*B*) *Wheeled animal transport.*

The heavy ambulance wagons (Marks V and VI) are not suitable for use under conditions with which I deal in this paper.

[1] "Official History of the War, Medical Services, General History," Vol. iv., figs. on pp. 604, 605.

The light ambulance wagon (Mark I) taking two stretcher or eight sitting cases (six inside and two outside), proved most useful under certain conditions as it could be used wherever limber tracks or roads existed, indeed, wherever a field gun could go a light ambulance wagon could go. We used them extensively in Macedonia.

As at present designed they have, however, certain important structural defects which detract from their utility and comfort when used across country or on rough roads and which necessitated frequent visits to the repair shop. These defects are capable of remedy and are briefly as follows :—

(1) *Forecarriage* (fig. 10).—(*a*) The straps and bolts marked "A" are too small and too close together, and are constantly breaking. They should be made the same size as those marked "B" and should be the same distance apart. (*b*) The spring has too much play and over rough roads breaks the securing plates, straps and bolts. From the same cause the tyres of the front wheels are frequently ripped off, owing to the wheels scraping the under surface of the footboard when a loaded wagon is being turned.

FIG. 9.

(2) *Perch.*—The perch is much too weak and is constantly breaking where the rear bolt of the front stays penetrates it. The front and rear stays should be continuous, and the perch should be fitted with an additional channel iron extending from front to rear axletrees.

(3) *Brake.*—(*a*) The brake shoes should be free so that their full surface will touch the tyre when the brake is put on; at present only the lower part touches. (*b*) If one tyre is new and the other worn, the brake acts on the new tyre only. (*c*) An adjustable brake is required.

(4) *Rear springs.*—When the brake is put on, the body goes forward and, as a result, the rear springs are pressed backwards out of position and break.

(5) *Water Tank.*—The rod which secures the tank is not strong enough and shakes out on rough roads, the tank falls off and is not infrequently lost.

The ambulance tonga—drawn by two bullocks or mules—was devised by Major-General Hathaway and the late Captain Noake. It is very suitable for ambulance transport where other forms of wheeled animal-drawn transport cannot be used

with comfort. The tonga is hung low, is very difficult to upset and carries four sitting or two lying cases.[1]

The desert ambulance cart.—A two-wheeled hooded spring cart with a spring bottom and drawn by four mules, was found useful in Palestine, as the wheels, fitted with metal tyres 12-in. wide, do not sink in the sand.[2]

Other forms of horse-drawn ambulance transport.—The G.S. wagon, the limbered wagon and the Indian A.T. cart can all be fitted up to serve as ambulance transport in emergency; also various forms of country carts, but, as ambulance work is not their normal function I will not take up space with a special description of their uses.

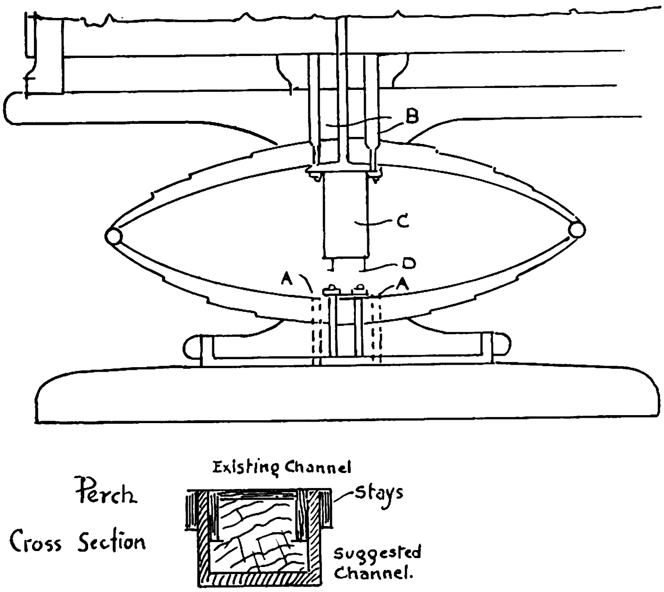


Fig. 10.—Ambulance wagon, Mark I. Suggested alterations and additions to fore-carriage.

Transport animals.

The mule has proved its value in war—hardy, patient, sure-footed, hard working, and (despite the exceptions which have sullied its fair name) lovable There are few places, even the most difficult of access, where a mule cannot go safely. For its services in Macedonia in carrying our wounded and our food supplies we owe it much gratitude.

For a long time the ambulance mules were trained and tended by R.A.M.C. men who were subsequently replaced by Cypriot muleteers but not, in all cases, to the gratification of the R.A.M.C. personnel or the mules! There is much to be said for the association of bearers with the ambulance transport animals and it is a moot point if training in animal management—more particularly mule management—and the essentials of pack and draught saddlery would not be worth while in rendering

1 "Official History of the War, Medical Services, General History," Vol. iv., fig. on p. 613.
2 *Ibid.*, Vol. iv., fig. on p. 616.

R.A.M.C. personnel independent in emergencies such as often confronted us during the War.

Mules must of course be carefully trained for ambulance transport. The majority are easy to train though some are fractious. On the whole they take kindly to litters and travois after a brief training with unloaded apparatus; at first a little puzzled, they soon settle down to them. Even if they try to bolt they usually set off in different directions and soon stop. With sympathetic, permanent drivers, they are very docile. The best type of mule for litters, travois and cacolets is the thick-set animal about 14 to 15 hands and not the largest sized mule. One of the drawbacks to mule transport is the amount of forage which it is necessary to carry for the mules.

The camel is also most useful for ambulance transport as it is easily trained and docile except when "musht," when it will readily bite, and few things are more horrible than a camel bite. In Arabia I have seen many cases of limbs bitten off by "musht" camels; a jagged stump is left which invariably suppurates. The chief disadvantage, however, of camels for ambulance transport is the discomfort to the patient caused by their gait, and by their way of kneeling and rising. Unlike the mule, the camel is easy to feed and will go for long periods without food. In this respect it is an economic form of transport; furthermore, it can carry two lying cases at one time in kujawahs.

Horses and dogs need no comment.

IV.—Motor Transport.

(1) Road. (*a*) Four-wheeled ambulance cars.—In Macedonia the only motor ambulance transport which we could use in the forward areas was the light Ford ambulance car, and its use was restricted to positions where roads of some kind existed. Even the main road of evacuation (Salonika-Seres) from the Divisions in the Struma valley to the base hospitals was so rough that for a very considerable time the unfortunate casualties were transported in the returning lorries of the supply columns for 70 kilometres or more and suffered great hardships in consequence. Later, when this and other main roads had been repaired, properly organized motor convoys using heavy ambulance cars were available and conveyed casualties, either from forward C.C.S.'s or field ambulance main dressing stations situated near the main roads to base and L. of C. hospitals.

(*b*) Six-wheeled ambulance cars.—With the development of the six-wheeled ambulance car it will now be possible to traverse roughish country on the plains where only the mule and other improvised transport, already described, could be used during the War. It must not be forgotten, however, that there were many situations in the hills where no six-wheeler could go and even on the plains a journey over rocks is no joy to a patient, even in a six-wheeler, and I have not yet seen one tried in deep glutinous mud such as we so often met with in Macedonia.

My chief criticism of the six-wheeled ambulance car is the fore and aft vibration when moving fast on a road and the fact that across country its pace, with comfort, is limited to 4 to 5 miles an hour.

I am glad to see in a design recently exhibited at the War Office the replacement of the canvas rear curtain by doors. This will prevent the patients being smothered in dust as heretofore. In the new car the exhaust heating can be cut off when

required, an important improvement for hot countries. An arrangement by which the upper stretcher carriers can be lowered for loading is also a great advance on the existing designs.

(c) The motor ambulance coach or charabanc.—I could never understand why so little use was made of this vehicle during the War. While with the 7th Division in France, I applied for three of these vehicles before every big battle in which the division was engaged, but never once were my requests granted although I am certain that no other conveyance would have helped so much to achieve the two essentials in dealing with battle casualties in forward areas, viz., their rapid and comfortable evacuation from the battlefield to a medical unit where they can receive adequate treatment. The lowness, carrying capacity and comfort of motor coaches render them eminently suitable for ambulance transport wherever good roads exist and enemy's fire permits. For sitting cases, and if converted to take stretcher cases, they would have been a god-send, not only in France, but also in Macedonia in 1916. They are much superior to motor buses which were used in France.

FIG. 11.

(2) Railway. Decauville railway coaches (fig. 11).[1]

When we arrived in Salonika there was only one broad-gauge railway serving the British zone and that was on the extreme left of a 90-mile front. Before the campaign was finished we had constructed many Decauville railways which served different areas and proved valuable in the evacuation of casualties. The small trucks could take four stretcher cases and a train of ten trucks could be drawn by mule teams or by an engine extracted from a Ford car.

In the latter case a speed of eight miles an hour on the level could be attained. As the vibration of rigid trucks made them uncomfortable for serious cases, specially built covered ambulance trucks were made by the R.E. according to specifications drawn up by R.A.M.C. officers and ran with marked success as miniature ambulance trains. These trucks were covered, marked with the Red Cross and were fitted up (by means of old bed-springs) after the Brechot pattern

(Also diagrams "Official History of the War, Medical Services, General History," Vol. iv., pp. 648, 650, 651, 652.)

to carry two, or, in the larger trucks, four lying cases. Such trains were notable features in the evacuation scheme on the Struma valley front in Macedonia, where cases had to be collected from a distant flank and transported to the Central Salonika-Seres Road whence they were transferred to motor ambulance cars for conveyance to the base hospitals.

(3) Air. Aerial ambulance transport.

The more I know of war in countries like Macedonia, the more I am convinced of the importance and necessity of a definitely organized system of aerial transport for serious casualties.

We know the vital importance of getting cases of penetrating wounds of the abdomen—including wounds of the liver, bladder and kidneys; penetrating and perforating wounds of the chest; head wounds, and also compound fractures of the thigh—to a hospital where they can receive adequate treatment at the earliest possible moment, followed by prolonged rest. Yet to the end of the war such cases were often carried many miles in slow moving animal transport and over rough roads in ambulance cars and even in motor lorries and by the time they reached hospital, if alive, they were often beyond hope.

It is just in countries of this nature, where fighting is not so intense, that suitable landing grounds for aeroplanes near the field ambulances might often be found, particularly for a machine like an autogiro which, in still air, requires no landing speed, or run, and a take off run of only 30 yards.

At a large medical staff exercise shortly before the onset of the Great War, when the Directing Staff from the Command explained how the wounded were to be brought back in the supply wagons and lorries, I protested that such a scheme would never work but was doomed to failure, and that the organization of motor ambulance convoys was essential. I was assured that the ambulance cars were quite unnecessary and could not be thought of! I had received similar rebuffs at other staff exercises in previous years when I had proffered similar advice—no doubt many others had a similar experience. Nevertheless, when I joined the 7th Division in France as D.A.D.M.S. I was fortunate, through explaining my views to a generous friend, to have two Rolls-Royce ambulance cars sent to me, via Dunkirk, for use in the Division. Needless to say they were invaluable, but were soon commandeered by A.H.Q. to help in forming a motor ambulance convoy for the Army!

History seems likely to repeat itself in regard to ambulance airplanes. I attended a medical staff exercise about three years ago, in which an armoured force made a wide raid, captured a bridge-head and left infantry to hold it. There were a good many casualties but no ambulance cars with the raiding force, and, to my mind, the correct way to deal with the serious cases was to get them back by ambulance airplanes, but, when I gave that as my solution of the difficulty, I was told to discard it from my mind as no aeroplanes would ever be available solely for ambulance work, they would all be required for fighting purposes!

The official solution was that the seriously wounded must be left with the enemy! Consider the effect of such a policy on the morale of the troops and on public opinion!

Unless more foresight is used, however, we shall doubtless do as we did in regard to motor ambulance transport before the Great War—neglect to organize aerial

ambulance transport until many valuable lives are lost and public opinion compels us to provide what is necessary.[1]

Zones in which to use different forms of transport.—In deciding this never forget your object, which is to get the wounded man from the battlefield to a suitable hospital as quickly as possible and with a reasonable degree of comfort. You will therefore use your rapidly moving transport as far forward as the local conditions of the country and the enemy activities permit.

If you can find landing grounds for ambulance airplanes near your field ambulance main dressing stations and the enemy's air force and gunners are not too active, it is obviously desirable that serious cases of the kind already mentioned should be picked up there by the airplanes and transported direct to a suitable hospital, where such cases can get the rest necessary for their recovery, cutting out the C.C.S., which in mobile warfare is not a stationary unit.

In regard to other forms of transport, remember the onerous nature of a stretcher bearer's work. The rate of evacuation by this means varies according to a number of factors, of which the condition of the ground, the climate and enemy activity are the most important. Over dry ground and in otherwise favourable conditions one mile an hour is good going.

Therefore, in order to conserve the energy of your bearers and speed up evacuation as much as possible, use mechanical contrivances as far forward as the situation permits.

I am much indebted to Major-General Blackwell for kindly supplying me with information in regard to the transport employed on the Indian frontier, to the late Major N. V. Lothian for some of the illustrations, and to various others from whom I have borrowed photographs, also to Mr. Gibbs, photographer, Royal Army Medical College, for making the negatives.

---

1 Since the delivery of this lecture and as a result of it, Lieut.-Colonel E. M. Cowell, D.S.O., R.A.M.C., T.A., who was present, has been in touch with various civil flying clubs and owing to his initiative, energy and keenness the organization of Voluntary Air Ambulance Detachments is now making considerable progress.

SOME IMPRESSIONS OF JAMAICA AND BERMUDA.

By Major G. G. COLLET,
Royal Army Medical Corps.

The Journal and News Gazette, arriving yesterday, showed me that new officers were due to come to both of these islands during the trooping season.

I thought of my own arrival in these islands, of the lack of information and false information which I had received before arrival, and the consequent difficulties and disappointments which might have been avoided. Although I expect much has appeared before in the Journal about these islands, I thought perhaps some up-to-date impressions might be of use to those officers and their wives who are shortly moving West.

I thought also that as few of us have the opportunity of being stationed in both islands, some impressions of them might lead to comparisons which I hope will not be odious.

(1) Jamaica.

On receiving orders to sail in a "Banana Boat" across the Atlantic in January, visions of bad tossings and presentiments of great discomfort arose in my mind, but on reaching the East India Docks I found a fine boat with all the modern comforts and with plenty of deck space, and which proved her good seaworthiness during a somewhat trying voyage. After leaving the storm area behind we had a most comfortable journey, and to anyone contemplating a journey to Jamaica I can strongly recommend the "Direct Fruit Line."

Lounging on deck travelling to a new country we had visions of lagoons and palm trees, of surf bathing and dusky beauties, of sunshine and romance.

As days pass and the sun begins to warm you and the London fog and damp, cold English climate are left behind, the heartache at leaving the home country lessens; for a time one is an optimist.

Haiti is to be seen on the port horizon; I think of Hawaii or Honolulu and am not sure of the geography of any of the three. Again visions of lagoons and dusky beauties rise to my mind; but instead a bleak barren coast with scrubby mountains, sun-baked and ugly, disillusions me; and to-morrow we arrive at Jamaica.

6 a.m. and Jamaica on the starboard bow; up we tumble on deck in our pyjamas with glasses closely held; our new home is in view. There are some palm trees along the coast, plantations can be seen amongst the mountains, but it is the same scrubby mountainous country we had seen in Haiti; we looked at each other and then lowered our eyes.

Disillusioned, and it is entirely our own fault.

Our visions had been of our own making, and the illustrated pamphlets for tourists are as often as not misleading.

This is the true vision of Jamaica on arriving, and to those who are shortly going there, there is now no need for disillusionment. The south coast of Jamaica is not a land of palm trees and beauties, it is a low coast gradually rising to the foothills of the Blue Mountains, Jamaica's main mountain range; the plain from coast to foothills is the Liguanea Plain, with Kingston Harbour at its foot, and you are going to live on this Liguanea Plain, and at times you are going to be very hot and uncomfortable on it.

There are palm trees, blue lagoons and luscious beauty in Jamaica, but all these beauties are on the north side of the island, and a whole day's journey off.

We are now entering Kingston Harbour and passing Port Royal, once the wickedest city in the world, the home of pirates and cut-throats, so wicked that the gods sank it under the sea. The modern Port Royal, once a popular station with Gunners, is now the isolated home of 3 officers, 2 wives and 20 other ranks. Lying at the end of the Palisadoes, along which no road is yet built, it is completely isolated from the mainland, and the only communication is by an infrequent boat service across the harbour. No R.A.M.C. officer is stationed there now, the civilian port medical officer having taken over the work.

We steam slowly up the harbour and reach Kingston, and our voyage is over.

Kingston is a bad beginning, a hot, noisy, crowded town full of motors and trams; and the sight of negroes and negresses in full European kit, overdressed and full of swank and obviously very much your brothers and sisters, does not impress you.

One warning before it is forgotten. Do not swear at a Jamaica negro when you are motoring; he will make you want to swear and curse, he will break every rule of the road and make your hair stand on end; he is the worst motor driver in the world; but shut your mouth, for if you don't you will hear such a string of words that will drown your mild explosion and reduce you to impotent anger. Again, do not be disillusioned, the black and you are equal in Jamaica with odds on the black, and the best thing is to make up your mind to this at once, it will save you much distress in the future.

You have arrived, and the next question is where to live. There was no quarter for us in Up Park Camp, where the quarters question is always a difficult one. There are three R.A.M.C. officers in Jamaica and there are only two quarters available, one for the S.M.O. and one for the D.A.D.H. I was neither. There are hotels of all sorts in Kingston; we went to one of the best and stayed there one week; we had one small room with a bathroom with no hot water laid on and indifferent food, and my bill was £25 odd.

There are also boarding houses in Kingston, and this is my experience of one of them.

We were advised to go and live at a boarding house in the suburbs of Kingston, which had a good reputation.

I had heard from a distance, when living in the hotel, the howling of dogs and crowing of cocks, but their sounds from a distance had been comparatively melodious, although I had heard that in the city their concerts were of ill-repute.

Now I had got to a suburb where little villas lay thickly around, and each villa had one or two dogs and numerous cocks of the crowing variety. I cannot describe the pandemonium at night; each dog is sent out into the garden when the residents retire to bed; each dog begins to howl soon after; the cocks crow three times a-night, at 12 o'clock, 2 a.m., and 4 a.m., so the Bible tells you; I found they crowed considerably more than "thrice." Sleep was quite impossible, and nights became hideous.

The landlady was apologetic, but obstinate. "We must be light sleepers." "Other people don't mind it."

I had to take more active steps, and did a frontal attack on the villas, where I interviewed owners of dogs and cocks; some were polite, others the opposite; from the last I was threatened with the police. I had already been to the police station, but was told that Jamaica had no "Law of Nuisances." Coming to an *impasse*, and my nerves being shattered with sleeplessness and irritability, I retired from the unequal contest, and left the boarding house with two deaf old ladies to keep up its reputation.

I have heard since that this dog howling and cock crowing is world-renowned, and had filled the local lunatic asylum with "killers." I can well imagine it; I was nearly a "killer" myself.

There is now a luxurious new hotel, "The Constant Spring Hotel," five miles out of Kingston, which was not built when I arrived, and where luxury and comfort can be found. We lived there for six weeks before we left the island; it is expensive, but is well worth the expense, and if we ever returned to Jamaica we should go straight there.

Up Park Camp lies some two miles out of Kingston, on the Liguanea Plain. It is neither "Up" nor a "Park"; it is a small cantonment with no park-like propensities. It has three modern quarters, and one of these is the S.M.O.'s; the remainder of the quarters were put up after the earthquake, and sent out in bits from Boulton and Pauls (this is a fact). They have been put on concrete foundations, and some have concrete verandahs and balconies, and concrete is not good in the heat. They are all two-storied, and some people say they are earthquake proof; others differ. The earthquake shocks we experienced whilst living in them inclined us to the latter view, and I am certain that a good hurricane would blow them away in a cloud of dust.

A quarter was allotted to us soon after our arrival, as there was one married officer below strength in the station. It was not one of the best,

and some people said it was the worst; it was, I really believe, the true cause of our dislike of the Liguanea Plain and Up Park Camp, for if one is never comfortable how can one be contented?

Servants are cheap in Jamaica. You keep a cook at 12s. a week, a "butleress" at 12s. a week, a washer at 10s. a week, and a boy who looks after your garden and car at 12s. a week. The cooks we found distinctly trying, but taken all round they are not too bad.

A car must be bought at once, for without one you are powerless to do anything; it is far too hot to bicycle, and the distances are great. I bought a secondhand six-cylinder Buick Saloon, and had no trouble with it during the whole of my stay in Jamaica. It was, however, heavy on petrol, and clumsy and heavy on the bad mountain roads, and I believe if I went to Jamaica again, I should buy a Ford.

The climate of the Liguanea Plain is nearly always hot and trying—January, February and March are pleasant, but the remaining months are unpleasant; however, there is no great heat to contend with. The sea breeze in the hot weather arrives daily about 10 a.m., and by 11 a.m. or 12 noon, blows all before it, and in your quarters, where you must leave doors and windows open for the sake of coolness, papers, rugs, and even pictures race before it.

Mosquitoes, at any rate in our quarter, were the most wicked and persistent I have ever met; they bit us night and day, and nets, oils and unguents were of little avail. Every officer in the garrison except two, and every wife except my wife, got dengue in the year.

However, let us turn to brighter things. Jamaica can give you plenty of varied recreation.

There is a small garrison club in Up Park Camp and a large civilian club, the Liguanea Club, within easy reach of camp.

My advice is to join the Liguanea Club at once, where the civilian element will broaden your outlook and enlarge your horizon and where the genial secretary will do all he can to introduce you to his friends. There are some very charming residents and I can say this, that most of the pleasure and happiness we had in Jamaica was due to the kindness and generosity of these residents, who were and are real good friends. You will get to know them gradually; some of them have lovely homes and you may be lucky to get to know some planters who will be only too delighted to put you up for week-ends and show you the real Jamaica life.

First class tennis can be had in Jamaica, there are good courts at the Officers' Club and the Liguanea Club, and most of the big houses of the residents have good courts. The new Constant Spring Golf Course will, I understand, be one of the best courses in the West; it is certainly a most beautiful course and some of the views from it are delightful.

There is polo in Jamaica and it is cheap; but it seems on the downward grade. Once or twice a year there are tournaments in Kingston between the three or four clubs in the island and some of the planters are really

good players. The Garrison Club still exists, but there are only four or five players and the standard of station polo was very poor indeed.

Bathing is, I think, the best form of recreation to indulge in, and although there is no bathing beach on the South coast which is safe from sharks, there are two first-class open baths within easy reach of the Camp, the Bournemouth baths and the Myrtle Bank bathing pool.

Bournemouth is a large open-air swimming bath lying a few miles east of Kingston and on the harbour shore ; it is the finest open air bath I have ever seen ; there you can swim in warm sea water, sun bathe, drink beer, dance and see many wondrous sights, for it is the mecca of all tourists in Kingston, and on Sunday the *rendezvous* of all the Kingston beauties, and a wondrous sight it is at times, with a good dancing floor upstairs it fulfils functions other than swimming. To take one's supper there on a warm moonlight night with a cheery party, and dance and swim, is an event to remember.

Myrtle Bank Hotel, the fashionable *rendezvous* of Kingston, has a new open-air bath at the end of its garden, a beautiful little bath with clear warm water from which most of the salt has been extracted and which is consequently pleasant to frolic in. It is more select than Bournemouth, the prices being higher, and here we went almost every Sunday morning and made up bathing parties, and perhaps these Myrtle Bank mornings are amongst the pleasantest recollections of Jamaica.

As yet we have only mentioned two cantonments, Up Park Camp and Port Royal ; there is the Hill Station, Newcastle, also to discuss.

Newcastle lies twenty-five miles from Kingston and some 2,500 feet up the Blue Mountains ; it is plainly seen from anywhere on the Liguanea Plain. It is reached by a fairly good road which requires care and skill to drive on ; it is not unlike the road from Peshawar to Cherat, but not so well kept.

Before the West India Regiment was disbanded, the British troops were all stationed at Newcastle with the exception of a small detachment at Up Park Camp and the Gunners at Port Royal, now Newcastle is only used as a change-of-air station in the summer months. One medical officer is always on duty there from April until October, and it is usually arranged for medical officers to go up in rotation. It is essential for everyone to get a good change of air at Newcastle every summer. Life there is very similar to that in any small Indian hill station. There are beautiful views; the quarters are far better than those in Up Park Camp ; you can laze, and the freedom from heat and mosquitoes enables you to read and think. There are a few charming walks, one tennis court and a swimming bath at Greenwich, within walking distance from Newcastle. You look down on the Liguanea Plain below and thank God for small comforts.

Do not think for one minute that Kingston and Up Park Camp are the real Jamaica.

Parts of Jamaica are beautiful and the views from Newcastle can be classed amongst them, but if you want to see the Jamaica that tourists come to see and rave about, you must go further afield; motor along the coast road to Morant Bay and on to Annotto Bay, take the road to Spanish Town and thence to Moneague, lying amongst hill scenery not unlike that at Ooty, then on to Shaw Park Hotel, lying just above the luscious tropical vegetation of Ocho Rios Bay. We found it hot and sticky and relaxing here in November, but the bathing in Dunn's River just below the hotel is worth a visit. Then motor along the coast road from Ocho Rios to Montego Bay, and the beauty of this road will, I am sure, entrance you. Montego Bay is the Lido of Jamaica, and promises to be a society

Fig. 1.—Shaw Park Hotel, Jamaica.

rendezvous in the near future, the bathing there approaching that found in Bermuda, and it is said to be safe from sharks.

On receiving orders to leave Jamaica and proceed to Bermuda we left few regrets behind us.

We were definitely glad to leave Up Park Camp and the Liguanea Plain, its unpleasant climate and its narrow monotonous existence; also the discomforts of our Army quarters had wearied us.

Some people like Jamaica as a station, but I fancy most of the good impressions of the country were made when there were more troops there and before the West India Regiment was disbanded. There is now half a battalion of Infantry, a few Gunners and a few of the auxiliary services, perhaps there are twenty officers and about fifteen officers' wives. It is difficult for all of us in such a small station, and you will find the same conditions in Bermuda.

(2) Bermuda.

It is rather absurd to attempt to write an account of Bermuda after being only four months in the island, but if my impressions are to help those who are soon arriving, they must be written at once.

We travelled from Jamaica to Bermuda by the P.S.N. Co.'s "Orbita," one of the "O" boats which touch Bermuda once a month and occasionally call in at Kingston. They are good boats but they take fourteen days to reach home, as they call at ports in Spain and France. Recently a new boat, the "Reina Del Pacifico," has been added to the line, which will, I understand, do the homeward journey in ten days. The alternative home route is by New York.

The approach to Hamilton, the capital and port of Bermuda, is a

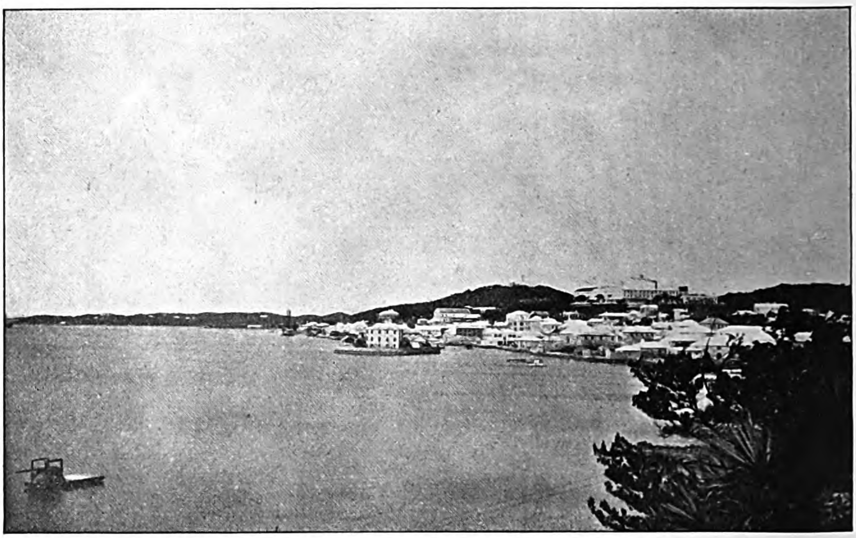


Fig. 2.—St. George's, Bermuda.

difficult one. The "Orbita" steamed along the south coast and anchored off "Five Fathom Hole," which is the opening in the coral reef which surrounds Bermuda. A tug came out and took us off, and coasting along the north shore, landed us at Hamilton. What impressed me first was the beauty of the colouring of the sea, vermilion and cobalt, and the transparent depths, and the hundreds of little white houses that seemed to cover the islands. I also realized from the abundance of cedar trees and the absence of palms that here was a subtropical and not a tropical country. The climate was fresh and delightful, and the approach through the "narrows" to Hamilton was really beautiful. Here was a very different country to Jamaica.

We had received a wireless the day before landing, asking us to stay

with an old friend who was acting Adjutant to the local Gunners and stationed at St. George's. He had come out to meet us on the launch, and when we anchored outside St. George's we had been within a stone-throw of his house; now we had a twelve mile drive to return there. We thus escaped all the difficulties and unpleasantness of having to double up or go into temporary quarters, which was great luck.

The first thing that impresses everyone on landing at Hamilton is the absence of motors; the sight of buggies and carts makes you feel that you have gone back a hundred years, which, in fact, you have done. It was a peculiar experience driving those twelve miles to St. George's as the clop clop of the horse along the road (now well nigh forgotten) and the familiar smell of harness and carriage recalled old memories of bygone days. It was so quiet and pleasant and so different to our arrival in Jamaica.

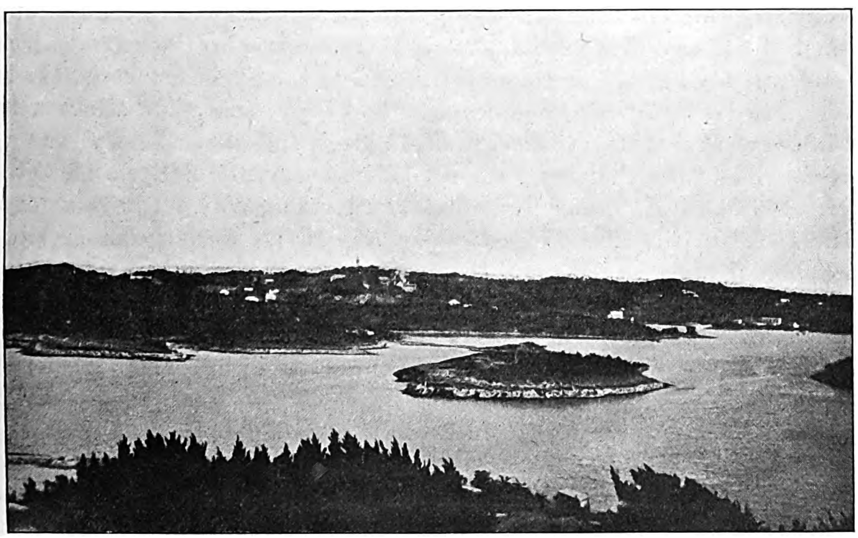


Fig. 3.—St. David's Island, Bermuda.

St. George's is the old capital of Bermuda and lies on a separate island connected by a long causeway to the main island; it used to be the home of a brigade of heavy Gunners who garrisoned the several forts there. These are now obsolete and falling to pieces; there are now only two officers and twelve men who are the nucleus of the local Militia; they have a civilian doctor to look after them.

My friend's house was situated almost at the end of the island and had a lovely view over St. George's Harbour, an inland sea on one side, and at the foot of his garden on the other side was the open sea. His home is completely isolated and is one and a half hours drive from Hamilton; he has been stationed there over four years, and yet he wished to stay one

extra year. Here was a family that enjoyed Bermuda and was happy there, but on inquiry I found that he took his full amount of leave every year!

Now notice a different tale. The day came far too quickly for me to start work, and I drove back to Prospect to take over my quarters there and also the hospital.

Prospect is the cantonment of Bermuda; it lies on a ridge above and to the north-east of Hamilton, the barracks being situated to the south and the hospital overlooking the North Shore. The bungalow I took over from my predecessor was next the hospital and had a lovely view over the North Shore, as had the hospital. All the troops now in Prospect are two companies of Infantry, and sufficient or more than sufficient ancillary services to look after them. There are three R.A.M.C. officers in Bermuda, an S.M.O., D.A.D.H., and one other. I was now the S.M.O. Soon after meeting the three M.O.'s I realized that their outlook on life in Bermuda was entirely different to that of my Gunner friend, they all three thoroughly disliked the place. I was told that little was good in the island, that the climate was trying, hot and enervating; that the expenses were very high, the domestic difficulties almost impossible; that there was little recreation and little work; that transport was difficult and that society was most limited. I had not then read a book called the "Lily of Bermuda," which described life in Bermuda immediately after the War. I have since read it, and I realize that the impressions of our M.O.'s were those described in this book. I must say at once that to a newcomer who had seen only the best parts of the local life, these views were a distinct damper. After four months in the island, although I cannot quite reconcile myself to their views, I can see the disadvantages of the station, but I can also see its advantages.

Within a week we were comfortably installed in our bungalow, and were charmed with it. After all in this best of possible worlds everything is by comparison, and the contrast of this bungalow to our Jamaica cowshed was striking; here was a little home in which we could live in comfort and take a pride, and after all, that is half the battle.

The servant question is undoubtedly a difficult problem in the island, but with two batmen provided, one to work indoors and one to look after the horse and carriage, a nucleus was there to start on. We heard of a negro cook who, in due course, arrived. She was huge and evil looking, and my wife was so frightened of her that she told her to go immediately. This to a Bermudian cook, who in her own estimation is a woman of great importance, was an unparalleled affront; she had brought her kit with her and meant to stay. When she got her *congé* she was speechless; I was delighted. We have got on extraordinarily well without her, with daily outside help. My advice to future arrivals is not to get into the hands of these native cooks if it can be avoided.

Transport I agree is very difficult, but the way out is a bicycle. The island is very small and to bicycle from one end to the other will only take

you two to three hours, but it is trying in the hot weather and the hills are troublesome.

Carriage travelling is slow and boring, but in this island time is no object. There have been two very serious carriage accidents this year, one proving fatal; it is most necessary to have a steady horse and a careful driver, and also to have thorough overhauls of harness. My horse is broken-winded and old, but rather than have an untamed horse I am hanging on to him. We always get there in the course of time.

A railway is now under construction in the island. There are two parties, a Pro-Railway and an Anti-Railway party; I, from a general survey of viaducts and bridges, am decidedly Anti.

As a new-comer and an inhabitant of the modern world, I cannot understand why Austin sevens with a speed limit, and broadened and asphalted roads, would not solve the whole transport question and save the necessity of this railway. You cannot permanently put back the clock. There are several motor lorries in the country, and I agree they throw up clouds of dust and go much too fast, but both these difficulties could be obviated.

Now as to climate. April, May and June produced the most delightful climate; when the south wind blew it became sticky, but when the wind was in the north it was cool and exhilarating. I agree that in mid-July it is at times sticky and enervating, but it has not been unpleasant yet and it cools down again in October. There can be no comparison between this climate and that of Jamaica.

I do not consider the expenses in Bermuda very high. The initial costs are high, as electric apparatus of all kinds, including an electric refrigerator, have to be purchased; but there is no car to buy. As to running expenses, food is dear, but stores are much the same as in Jamaica; vegetables if bought are expensive, but everyone grows their own. Washing is dear and wages are exorbitant, but apart from this, with the absence of a car and with free forage for your horse and a very small club bill, I have found that my monthly expenses are the same as, or lower than, those incurred in Jamaica.

If you are going to enjoy Bermuda, it is essential for you to enjoy bathing, boating, sailing and picnicking. The bathing is superb, Bermuda being able to produce the most beautiful bathing beaches imaginable; there are bathing beaches to be found all round the island, each producing a white soft sandy beach and clear crystal water. Here you can lie and laze all day, sun bathe, swim and picnic. One or two, including Elba and Coral Beaches, are the *rendezvous* of American tourists and full of wondrous sights and beauties, others are quiet, peaceful and deserted. Bermuda is indeed a gem of its kind; its coastal scenery would, I think, be hard to find paralleled anywhere. Little bays, each of which is a treasure, are tucked away in odd places.

Sailing also is good. I have been out many times and can appreciate what an enjoyable time I could have if I were an expert at the art, but I

am only of use as a deck hand. Motor boating and speed boating are amongst the other aquatic hobbies you can indulge in, but it is essential that you should know the geography and various passages amongst the islands first; it is tricky work until you do.

There is a tennis club in Prospect where five good courts are available, but I know of no civilian club to join.

Golf courses are numerous, several are first class, amongst them the Mid-Ocean which is, I believe, one of the best in the Western world. They are expensive.

There is no polo and no riding worth indulging in on the island, and although Bermuda can produce a Hunt Club whose activities are, I believe, at times, alarming, and where I hear pink coats and top hats are *de rigueur*, I propose to be a looker on. There is no shooting, but sea fishing is, I believe, good.

If you are a keen dancer you can dance every night of the week at a different hotel. Every hotel, and there are dozens, has a dance floor and orchestra, to which admittance is free, and in the season, the Hamilton, Princess, Bermudiana and Belmont Manor Hotels are well worth a visit even if you are, like me, only a looker on. Some amazing sights can be seen.

There is one point on which I am certainly in agreement with the three M.O's. mentioned before, that is, that the society in Bermuda is limited. In a tiny cantonment such as Prospect it is essential to have outside friends, but the population is mostly made up of American tourists, many of whom only come for a short holiday.

I have so far failed to find out what the resident population consists of; this is a great disadvantage in comparison with Jamaica where, as I have stated before, such great hospitality and friendship was shown us by the local residents.

No change of environment is possible in such a tiny island as Bermuda; it is, I believe only twenty square miles in area. To be cooped up in such a small island for three years with a handful of troops and limited society is not an outlook to look forward to, however beautiful the island may be.

In both Jamaica and Bermuda life must not be taken seriously; in both islands life approaches at times the comic opera standard. Fifteen months in Jamaica were more than enough for me, and I quite expect the same time here will find me equally anxious for a move. At present I am content with small mercies and am still revelling in the beauty of the island and am living very much by and in myself and dispensing with other things, but I look forward to bigger places.

———

THE DOCTOR'S WAR.

By D.A.D.M.S.

(*Continued from p.* 366.)

Our friend, the diplomat-interpreter, was amusing in his easy, nonchalant way, but used at times to annoy my chief by his somewhat licentious tone of conversation, and one or two angry scenes occurred. The A.P.M. was a dear, but so hard worked in scouring round the place that we only saw him at breakfast. Our Cambridge don was a bit didactic, and peevish at times, but a good chap. He frequently loaded himself up with select foods and bottles and took himself off to spend the night at some Company Head-quarter dug-out in the line, just as an experience, and to add what he could to enliven the monotony of trench life. In past days the don had been trying at times; for one thing, he snored louder than anybody I ever met during the silences of the night. On several occasions, when we all dossed down on the floor of some deserted estaminet or cottage, he kept the whole mess awake. He worked, unconsciously of course, on a system. Started mildly with a gentle hum, gradually rising in tempo to a rasping buzz, changed to a shattering roar, and finished with an explosive snort. Then silence for a few minutes, and off he started again. The only way to shorten this concerto was to throw a boot against the wall somewhere adjacent to the sleeper. This instantly produced the snort and ended the performance a few minutes sooner than would have happened if the ordinary routine had been allowed to continue. During this spell of silence we all tried to get asleep. Sometimes it worked, and sometimes it did not.

It all sounds very trivial, but tired men have murder in their hearts when prevented from getting sleep.

Changes rapidly took place in the staff. G.S.O.3 would rise to No. 2, as No. 1 became a Brigadier and went off to command a brigade, or to take on a corps job. D.A.A. and Q.M.G.'s became A.A. and Q.M.G.'s as their seniors departed to higher appointments with Corps, Army or G.H.Q. But the auxiliary staff remained where it started, and, I suppose, necessarily so, but it became a bit depressing to see this rapid change going on, and it meant constantly dealing with new people. And be it remembered that the working of the medical services is enormously dependent on the personal touch with the fighting staff; an easy, friendly intercourse carried on daily is a fifty per cent advantage. In times of stress the battling staff forgets all about its auxiliaries for the moment, and tells them little or nothing, so you find out for yourself. It is common sense after all. A man whose mind is completely occupied with urgent affairs gets irritated if asked formal questions at stated times, but parts readily with information in

ordinary conversation. I do not say this is the best method, but it has been the method of the British Army as long as I have known it; and I venture to prophesy it will be the same as long as the British Army exists. As an outsider, coming to a Divisional Headquarters, the first thing that strikes you is the easy familiarity of all ranks—perfect respect and discipline, mind you—but a lot of "Ask George about it," "Bobbie's the lad for that job," "Tim will tell you all you want to know," etc. Just a nice, friendly, chatty way of getting on with the job. But there is also undoubtedly a "water-tight" method of working. The "G" compartment is inclined to cut itself off from the "Q" compartment when working out schemes of impending battles, and tells "Q" about what is going to happen in its own good time, and, believe me, the medical department is told the programme last of all. Hence my stressing the "personal" touch. If a medical staff officer sits in his office and waits for information to come to him, as it ought to do, he may get very badly let down through no fault of his own. To be quite frank, this slowness in imparting valuable information to the auxiliary staff is partly ignorance of the work required to be done, and partly a sense of disinclination to impart information of approaching events, lest intentions should leak out to the troops and get talked about. And the further we get away from the War the more this silly system of secrecy creeps in. I know of manœuvres of late years, where all plans were prepared excepting the scheme of evacuating the casualties which would occur if it was the real thing, war, bloody war. At the last moment some junior staff officer is sent to see the A.D.M.S., to show him the scheme, and ask him to let the staff have his ideas of dealing with casualties in the course of the morning! If the A.D.M.S. is wise, he will refuse point-blank to do anything until he has had full time to go through the scheme in detail. But—you cannot do this sort of thing in war without risking a catastrophe.

We now have the A.D.M.S. of a Territorial Division attached to us for instruction. This is part of the "Cook's Tour" system. The staff of divisions marked down at home for coming to France are sent over to spend a week or ten days with the Divisional Headquarters of a division in the line. A very sound idea, because no human being has any idea of what a war is, until he sees it going on, and is *in* it himself. Reading books will not teach him anything, and certainly the accounts of war as turned out during the years 1928-30 would not teach anybody anything. But there were no war books in 1915, and it was all practical instruction on the spot. From my point of view the work consisted in a round of field ambulances, main and advanced dressing stations, bath houses, convalescent rest stations, regimental aid posts and support and front line trenches, showing as best as one could, the organization of the Divisional Public Health Services. One of our brigade commanders, a South African War V.C. man, is sick. He lives in a somewhat precarious billet in Armentières. Shells fall about, and there is nothing to prevent a shell coming in at his bedroom window and putting a violent end to his

career. But nothing will move him. He will stay where he is and get better or get worse, but he will not be moved. He knows very well what happens to Brigade Commanders who go sick and are sent to Base hospitals at Boulogne. They do not come back; they get sent to other Base hospitals in England, and the next you hear of them is that they are commanding Defence Forces at some English seaport town, or are on their way to Egypt or India. So the V.C. warrior stuck it out, and finished as a full General and a Governor of one of our Overseas possessions. I think the same Brigade Commander was the one man I met in the War who *liked* war. He had either no nerves, or iron nerves. He went round the front line every day as a brigadier, and later on when he commanded a division, he went round two or three times a week, and still later when he commanded a corps he got an arm blown off when going round the trenches. He would have made an ideal platoon-commander, he would have liked going out on raids into no-man's land. He brought his small sons from school in England, from pre-school holidays, met them at Boulogne in his car, brought them up to a singularly unhealthy Divisional Headquarters and took them round the trenches! Personally I thought this latter performance was quite mad. If those youngsters had been killed by a stray shell what a row there would have been!

One day the chateau we were in (I am anticipating a bit) was shelled at 7.15 p.m. Some of the divisional signallers were wounded. At 7.30 p.m. I met the General going in to his dinner. He stopped a second. "Any-one killed?" he asked. I said, "No killed, three wounded." "Ah," said he, "very satisfactory," and passed into his dining room. Was this a cold disregard of what happened to those minions, the wounded signallers? Not a bit of it. He saw we were all a bit rattled and he steadied every-body with his calm matter-of-fact manner. He got over his attack of bronchitis in Armentières, though the same disease killed him some fourteen years later.

I did a round of trenches with the G.S.O.1 and a distinguished visitor, then known as "Eye-witness." It was an easy bit of the line, and beyond casual rifle fire things were quiet. For the first time, I heard a staff officer, and a very genial type of man he was, exhorting the men to be strong in battle, to be fierce and spare not. "Give the blighters hell boys, worry them all the time, that's the spirit, my lads." I suppose the spirit of the Christmas truce was in his mind, and the word had gone forth to breathe the offensive spirit. It did not seem terribly necessary to me. Some forty yards away were the enemy's trenches, little wisps of smoke rising from them as brother Jerry cooked his sausage, as our men were frying their bacon, but on each fire step stood a sentry squinting through his loop-hole and having an odd pot shot at over the way, the whine of an over and the buzz of a ricochet showed that Jerry was wide awake also. If either side showed sudden truculence, both were ready to reply in kind, but, for the moment, nobody wanted any undue offensive spirit to interfere with

culinary operations. *We* were going away in a very short time, back out of range of those busy little bullets, and *they* were staying behind for another four or five days, and then only going away for a few days and coming back to this continued bickering with rifles, machine guns, trench mortars and what-not. I wonder what the men said as we filed off down the communication trench on our way home to headquarters; as a matter of fact I do not wonder a bit. I know exactly what they said. But suppose the G.S.O.1 had made an heroic gesture and, embracing the nearest private, said "My dear fellow, I refuse to leave you, I will stay with you, I will share all your dangers, I will share your dug-out, I *will* be wet and muddy and cold as you are, I will never desert you." I also know what the private would have said then!

The next anxiety was "gas." I quote from my diary: "Saw field ambulances *re* preparation of face masks composed of layers of gauze sprinkled with soda bicarbonate to act as preventive against the use of noxious gases, believed to be something in the nature of nitrous acid gas, but no definite information received. Reports say the gas came rolling along the surface of the ground in thick yellowish-red masses." We did not seem to know much about it, did we? Wire came from army that a gauze or muslin pad soaked in water and worn as a respirator would protect. For the next few weeks we worked feverishly at supplying the troops with gauze respirators and a solution of sodium bicarbonate to moisten the gauze pads with. I think it was the A.D.M.S. who had a brain-wave. The supply of solution of soda in buckets in the trenches was not practical, in case of a sudden gas-attack the men must have some individual means of defence, they could not go running up and down the trench looking for buckets of solution. So something in the nature of a small bottle for each soldier was wanted. But that meant some eight to nine thousand bottles for the infantry alone! So the A.D.M.S.'s brain-wave was—get all the nip bottles of stout you can and issue one to each infantryman. Off to Paris dashed our gallant diplomat interpreter, and by some means or other we were flooded with supplies of these little empty stout bottles. Soon each man carried in his kit: (1) one gauze pad with tapes attached; (2) one small bottle containing a solution of bicarbonate of soda. It is not quite easy to suddenly equip a division of 20,000 with such a curious outfit, and it is not easy to cope with the filling of 20,000 bottles with a solution of bicarbonate of soda, getting corks for 20,000 bottles, and replacing broken bottles, and seeing that each man in the line could produce a full bottle and a respirator at any given moment. It all sounds comic now, but it did not look comic when I drove over to Bailleul and saw the gas casualties from Ypres, rows of poor fellows rolling about on stretchers in the agony of trying to get a breath, blue in the face, coughing up pints of frothy sputum, and the exhausted dying ones lying still and blue and just drowning, the lungs engorged with fluid. And those I saw were the men who got back. There were many more who never got as far as the regimental aid post.

Now we knew that our pitiful little face masks were practically useless, but we *must* keep up the *morale*, the men must have something to believe in. The feeling that they were entirely at the mercy of a favourable wind carrying gas, spelt panic, and so we worked away, praying that gas would not be used against us until supplies of the smoke helmet commenced to arrive from England. The gas, of course, was chlorine. Just chlorine, and not mixed with the deadly phosgene as was done later by the Germans. One often now reads of attacks on the staff because we did not sit tight on the tank until we had enough for an immense concentration and a big break through. But why did not the German Staff sit tight on their offensive until they had sufficient supplies to put up an attack everywhere and at every time when the wind was favourable? Judging from what I saw in one division, we were unprotected for weeks and weeks, and could not be otherwise. Gas was a complete surprise and unanswerable without an extended time to enable your opponent to find out what gas you were using, and what the protection would be, and then sit down and supply an army with protection for every single unit in that Army. A colossal undertaking and yet we did it! However, at the time we worked away with our local activities increasing day by day as more information came in of possible defences. Spraying down the gas cloud was recommended, so scores of garden sprays were obtained; a solution of hyposulphite of soda mixed with glycerine was the latest idea, so that our demands for the division were six hundredweight of hypo. and 180 pounds of glycerine. Then came secret orders that an attack was coming off south of our line, and we were to make a demonstration to deceive the enemy into thinking we would also attack.

Once more a comic side to war. Troops in the line were to cheer fiercely at intervals, lorries were packed with odd troops and driven up and down the streets of Armentières, the occupants were also told to make as much noise as possible, parties of signallers at high points flashed signals about of movements of attack, and so on. Whether the enemy was frightened by all this war-like clamour I don't know, but for the next few days things were very quiet on our front. Poison has been reported in streams flowing from the German lines to ours; arsenic equal to 1 grain per pint was found on analysis. Stringent orders were issued about drinking water, and all such streams were to be carefully watched and frequent samples taken. It is borne in on one that this is a very dirty war and looks like getting more so. By this time we had established an up-to-date chemical laboratory in Armentières and did all our own experiments on the utility of the various protection methods against gas. The chemist was an officer serving in an infantry battalion and was now O.C. laboratory. We seemed so settled in this bit of France that it was quite a shock to hear we were to move. Started handing over field ambulances positions to the relieving division. As a matter of queer interest I quote these figures :—

Divisional Rest Station.—Period, November 17, 1914, to May 27, 1915:

Admitted, 4,752; discharged to duty, i.e., back to their units; 3,277; sent to base, 1,348. This means that 3,277 men remained with the division who would otherwise have been sent to the base.

Then comes a strange bit of statistics: Number of baths given in the same period, 37,725! Well, well, we washed a lot of soldiers if we did nothing else!

I visited Poperinghe to meet the medical staff of the division we were to relieve. I was told to be at the mairie at 3 p.m. and there I arrived. I found the town completely deserted, the few cars standing outside the mairie were the only signs of life in the place. The German big gas attack on Ypres had just come to an end, and the town of Pop. had suffered sufficiently to drive away the inhabitants. We had a solemn pow-wow and stole away silently from the stricken city. I thought everyone seemed to have the "wind up" badly, but I was just an innocent lad, ignorant of the troubles and tribulations of the salient. I learned to know them well enough during the next nine months. The billet in Proven was a quaint little house in a small square facing the church, the office was in the main street, and we messed in another place. I remember my bedroom was over the midden, and the smell of ammonia was so strong that I could never climb the stairs without a cigarette going, and smoked furiously until I got the window open and my head outside. There seemed considerable confusion in getting our line fixed up; eventually we got two brigades in the line and our field ambulances settled down. It is remarkable to note that at last we were to be completely fitted up with a complete motor ambulance outfit in this month of June, 1915.

Vlamertinghe, June 8, 1915.

Moved from the smelly Proven to this distinguished chateau. It was one of those extremely ugly erections, with two pointed towers at each end, an imposing broad flight of steps leading to the front entrance, and a deep balcony or stoop at the back. My chief and I had a palatial bedroom, tall windows, heavy tapestry curtains, but swept of furniture. We fitted up camp-beds and were very well housed. On the ground floor we had a small room as an office, and I learned later to like that little room because it *was* on the ground floor. Gas measures were energetically pressed, as we were in the area where gas was known to exist. We now had smoke helmets and practised walking through experimental trenches filled with chlorine gas. The smoke helmet I had worked all right.

Many changes had recently taken place in the staff; a new divisional commander, new G.S.O.1, and A.A. and Q.M.G. Our old cheery A.P.M. departed and we had a real French officer interpreter and also a Belgian officer attached. One was a count and the other a baron. So we were quite an aristocratic mess now. Also we had attached the "Admiral." He was an officer of the R.N.V.R., wore a naval cap and buttons, had his

own car, and was a priceless acquisition. This officer had a dull job at Boulogne driving people about in his car. He got very tired of this and wanted a more warlike life. So one fine day he picked up a divisional staff officer returning from leave and offered to drive him up to Vlamertinghe, but on a condition. The condition was that he should stay with divisional headquarters and thus escape from Boulogne. So it was, and the Admiral became one of us. He told us afterwards that he was subsequently reported "missing" from his unit at Boulogne, but that did not seem to worry him in the least. Anyhow, there he was, and there he stayed until, alas, a time came when he was reported "missing, believed killed," and we saw him no more. He was a man of great activity and eventually designed, and had built at his own expense, a sort of walking shield fitted with a machine gun. He had a few men trained in working this thing. They pushed it along the ground by means of a sort of shaft, and it had small wheels to run it along. And it was, in short, the first idea of a tank, something bullet-proof that could advance on the enemy and shoot him down from behind its steel covering. I know he got it out one day in front of the Buffs' trenches, up a road leading to the German wire, but something went wrong, and the Admiral and crew had to retire hurriedly to the trench, leaving this queer looking engine just in front of the Buffs' bit of line. The Germans had grave suspicions of this move and shelled the engine to bits, and incidentally the Buffs' trenches. Consequently, the Admiral was out of favour for the moment, and his inventions were not popular. Another dodge of his was a caterpillar thing that could be projected along on an endless winding gadget, would carry a stick of explosive and crawl out to the German wire, leave the stick of explosive under the wire, crawl back again, and then by an electric contact you fired the stick and up went the Boche wire. Very ingenious, but unfortunately shell holes deflected the caterpillar and it had a way of crawling back to where it started from, carrying its high explosive with it, result being a hasty stampede and much intensive cutting of wires. But the Admiral had the right idea in his head, that something more than the man with the rifle and bayonet was wanted to crush down the wire and storm the trench.

As well as being a keen soldier he was a keen sportsman. Often he had an afternoon out with his scatter-gun and produced a brace or two of partridges. His shooting ground was anywhere except no-man's land, and eventually his dog got so badly gassed, scrambling in and out of shell holes still holding gas, that the poor beast had to be destroyed. Of course there existed rigid laws and regulations against shooting, but the Admiral was a law unto himself, and always got away with it. He even met the G.O.C. during one of his shoots, and was only asked if he had had a good bag!

Once this soldier-sailor offered to drive me to Boulogne when I was going on five days' leave. He did so, and gave me the fright of my life. Apparently he had made a bet he would drive from Vlamertinghe to Boulogne without being stopped at any road post or barrier. His method

was simple. Approaching places like St. Omer, he drove full split at the road posts, tooting his horn, pointing to his naval cap, and shouting "despatches"! In every case there was a hurry and bustle to let him through, without asking for a pass, and if we had been German spies on our way to shoot up the whole of G.H.Q. things could not have been easier for us. At times I felt extremely uncomfortable. I was sitting in the back of the open tourer, and I could see a glimmer of doubt in the eye of a sentry as to whether a shot through the back of the car would be a good thing or not. However, it is a fact that we did not actually pull up until we arrived at the Boulogne barrier. Even the Admiral was not taking any risks with a French territorial, armed with a nice antiquated 1870 rifle.

I had my five days' leave; a beastly rough crossing. I was as sick as a cat both ways, and felt little the better for the change when I was back in old Vlam. We were now in close proximity to our Corps Headquarters. They were at the Chateau Coutove, on the Pop.-Proven Road, and we rejoiced in a popular and cheery D.D.M.S. who believed in close contact and held monthly conferences for all medical officers. They were unique gatherings. I suppose we often had thirty or forty doctors of all ages and positions. The spruce staff people from G.H.Q., generally bringing a consulting surgeon or physician with them, some well-known London or big provincial man, the divisional medical staff people, the field ambulance commanders, and the regimental medical officers. The latter in their trench kit, straight from the line. They were good shows, and we got together and learned something every time. The D.D.M.S. Corps was the true type of the fighting-man doctor. He had earned his D.S.O. as a regimental M.O. in the South African War, and battle, murder and sudden death were all in his day's work. He loved and honoured the regimental doctor, the man we all admired, the man who bore the brunt of the danger and discomfort of war. We fellows, even as far back as a divisional headquarters, had our little comforts and civilized modes of life. His life was the same as the infantry soldier, from trenches to so-called rest billets and back again to the line. His home was either a dug-out or a share of a Nissen hut. And the regimental doctor was rarely a young man as things went in the War. Even lieutenant-colonels commanding battalions were in the late twenties or early thirties, and often the doctor was a man of forty, often the oldest man in the battalion, but sticking everything that the younger men were sticking. We had some splendid fellows. They were all splendid, but some were outstanding. One doctor, an old school friend of mine, was so beloved by his battalion that the O.C. once said to me: "Do you know, I consider our doctor is worth two companies to me, as long as he is with us." Being one of the salt of the earth, he naturally went back to it. After two years of service with the same battalion he went out one night, he had often done it before, to collect wounded in no-man's-land, and he stayed out there himself.

Only once at our monthly conferences was there a jarring note. It was

one of our biggest meetings. We had been asked to bring in all the regimental doctors we could collect, and the room was packed. Solemnly the D.D.M.S. rose and spoke to us. He had, he said, that day received a letter from a medical officer, giving him much disturbance of spirit, and he would read it to us. The letter was a complaint and a demand to be at once sent to a base hospital; the reason given was that the writer was only wasting his talents amongst the rough soldiery. The work he did could be carried on by any semi-trained stretcher-bearer, and, in short, the position he held as a doctor to a battalion of infantry was beneath his dignity as a professional man.

Sorrowfully spoke our fine old D.D.M.S. He felt this attack on the services of a noble body of men as an attack on himself and his own past. He called upon the writer to stand up and speak before us all, but, if the gentleman was present, he did not give any sign. Personally, I think now it was just a case of what Stanhope called "another little worm trying to wriggle home." But since those days I have heard the matter discussed. To be brutal, it comes to this. Is it necessary to keep a scientifically-trained professional expert in a position of continual danger in order that he may be at hand to put on a temporary dressing or temporary splint, stop a bleeding artery (quite a rare occurrence) and, in other words, do the work of a "dresser"? If some officer or soldier did die a bit earlier than he might have done because the "dresser" made a mistake, or did not quite know what to do in a crisis, did it matter very much? We hear the Germans sent up dressers and kept their doctors further back. We know the home front suffered from a lack of doctors. It is a question that can be debated from both sides. Our advanced dressing stations in this regrettable salient were very poorly protected and came in for all the odd shelling that the salient suffered from. As the gunner said: "I don't mind being shelled from the front and from both flanks, but this being shelled from the back gets my goat."

It was almost that. The salient was so stuck out that if you were up near the apex it was practically possible for the enemy to shoot at your back. So we went on patching and mending dressing stations. And, of course, we must have a bath house. So we started one in the village of Vlamertinghe. Unfortunately the Boche shelled Vlam. one afternoon and the remnants of the bath house were deserted. Our next bath house was situated in Pop. and lasted out my time.

One strange thing about the medical life of the salient was the necessity to do all the collecting of the sick and wounded from the front line by night. All approach roads were regularly shelled, and Ypres was a city of sudden death. So at night the motor ambulances started off from Pop. and Vlam. and drove through the dark. Once past Vlam. all lights went out, and we crept along in total darkness. It was a weird journey. One crawled along with an "observer" standing on the running board. His duty was to call out "Shell-hole on the right, left or in front," and keep up

a chant of "Keep to your left" as we overtook marching troops and transport going up for reliefs. Through Ypres, through the Menin Gate and on to the aid posts at Potijze, St. Jean and La Brique. Some nights it was quiet, at other times it was a nightmare journey of smashing shells, screaming and whistling into Wipers. The motor ambulance drivers were a wonderful lot of men. They knew the roads so well, they seemed to sense their way, swerve round well-known shell holes, check at unfilled holes in the road, and creep past guns, G.S. wagons and transport in the dark night. But they did not last long. The work was too trying, and they broke down in time.

One night a padre said he would like to go up. He sat beside the driver. It was a bad night and much shelling. Coming back through Wipers they got it badly, and the driver hustled all he could. When they got to the dressing station at Vlam. the padre was sitting strangely quiet. They lifted him down, and found shell splinters had got him in the head and abdomen. I do not know whether he lived or died. He was sent on at once to the casualty clearing station.

As always in war, tragedy and humour come close together. Another dark night, the ambulances were halted outside the jail in Ypres, now used as a dressing station, and very fine cellars it had. The M.O. in charge that night was a bit jumpy and wandered about restlessly while the cars stood waiting with their engines running quietly; one did not consider saving petrol in Wipers! Anyhow, the M.O. came to rest at last in close proximity to the exhaust pipe of one of the cars, though he could not see where he was in the darkness of the night. He sniffed, and sniffed again. What was that queer choking sort of smell? Why, of course, "Gas, gas!" he yelled. "All respirators on." Intense excitement prevailed, until the M.O. in charge of the dressing station, coming out to see what it all was about, turned a cautious electric torch on the gas alarmist standing in the blast of the exhaust pipe complete in his respirator.

The aid post at Potijze was in the remains of a chateau, with quite pretty grounds round it. Various dug-outs were built in the garden, and the occupants of the chateau ruins took refuge there when things became too hot. For some strange reason the M.O.'s part of the chateau consisted of a glass-covered sort of conservatory sitting-room, built against the side of the house. Here we used to sit and have a drink and a cigarette while the ambulances were being loaded up with the sick and wounded of the day. There is a story about this conservatory glass house. One of our most gallant regimental doctors, I have spoken of him before, was doing his turn in the line, and occupied the Potijze dressing station. One afternoon the enemy turned on their guns and furiously shelled the chateau and grounds. Everyone took shelter in the dug-outs and waited patiently until it would be finished. Somebody said: "Where is the doctor?" He was not with them, and one officer remembered seeing the M.O. sitting in a deck-chair reading peacefully under the glass roof just before the shelling

commenced. All were disturbed in mind, and feared he had been hit, or worse. As soon as the "hate" was over, they emerged from their funk-holes and walked back to the chateau. Much damage had been done, and bricks and rubbish were strewn about. The hearts of all sank, as no sign was yet seen of the doctor. In trepidation they approached the miserable glass shelter, unimpaired excepting for some more broken glass about, and entered. There, in the deck-chair he sat, reading his book in placid contentment. They looked at him for a moment, and then asked: "Did you happen to notice some shelling going on during the last hour?" "Oh, yes," he replied. "I heard that all right, but my rule is always stay where you are when shelling starts. To move about is very dangerous!"

Though war goes on, the health crusade must not slacken. Once again the anti-enteric inoculation has to be intensified, as G.H.Q. has ruled that men receiving only one inoculation, instead of the recognized two doses at ten days' interval, must now receive the second inoculation of one cubic centimetre to protect them for another six months.

Another little call on the medical department was a sudden 'phone message to say that the "cemetery at the Menin Gate was smelling badly, due to the churning up of corpses by German shell fire." I copy that exactly from the diary as it seems to me the situation was rather well described. The message ended, "What do you propose to do about it?" Obviously the first reply would be, "Kindly ask the Germans to refrain from this revolting practice," and the next would be, "Indent for chloride of lime." The next little job was to improve the shelter for the wounded at Potijze. Hang it all, that wretched shanty at the chateau was asking for trouble. I made a nice little plan of several mounds in the grounds, ornamental excrescences of sorts, capable of being dug out and made into shell-splinter-proof dug-outs. One cannot get away from the bath house. The one we now have in Pop. is producing trouble. The soapy water from the bath house is discharged into a stream, and the French complain we are fouling the stream. So we must clarify the dirty water before it goes into the stream. O.C. sanitary section will arrange. Incidentally a sanitary section is a small unit whose duties are confined to doing anything in the sanitary way that a mere 20,000 human beings may require, and it is a full-time job. We were lucky in having as O.C. a trained sanitary engineer, and once he got away from thinking in terms of the borough council of an up-to-date English town, he became a perfect genius at improvisation. In one of our billeting areas, a hutment in some woods, water was scarce and had to be economized. Our O.C. sanitary section made a nice clarifying plant that received the soapy water from the ablutions of men and clarified it back again into clear washing water.

(*To be continued.*)

Editorial.

LONDON WATER SUPPLY.

In the Twenty-fifth Annual Report on the chemical and bacteriological examination of the London waters, Sir Alexander Houston gives a summary of his research work carried out during the past twenty-five years.

Many of the investigations cannot fail to be of interest to our readers, especially the work on chlorination. Sir Alexander writes : "Chlorination has come to stay, it was looked upon with great disfavour in 1905, but the Great War taught us many lessons and counsels of perfection have been largely displaced by doctrines of expediency. The great majority of water supplies in Canada and the United States are now chlorinated, and since 1916 the Metropolitan Water Board have greatly extended and are extending their operations in this direction—even at the present time most of the London water is chlorinated."

The change of front from hostility to tolerance and from tolerance to appreciation is remarkable. The publicity which chlorination attained during the war taught the people that the process was a perfectly harmless way of killing the germs of water-borne disease.

The story of chlorination as it developed in the Army was told in an article "On the Purification of Water Supplies on Field Service: a Retrospect," published in this Journal in September, 1925. In pre-war days the objection to chlorination was the production of taste troubles, and in the article mentioned it was pointed out that the greatest trouble was often experienced with well waters, highly polluted bacteriologically but containing little matter in suspension. It was remarkable that even after the test-box had been devised and the amount of chlorine required could be determined with some exactitude, well waters treated with a *minimum* dose might acquire the most nauseating taste.

Houston says in his report : "It seems incredible that the presence in water of one thousand-millionth part of certain substances which in themselves have no taste, except in vastly greater concentrations, should on the exhibition of a tasteless dose of chlorine render the mixture almost undrinkable. Yet it is abundantly true, and it has required an enormous amount of research to understand and combat these difficulties."

In peace time a water consumer has a right to expect that the water supplied shall be free from germs of water-borne disease and tasteless. Fortunately this result can be obtained quite easily by super-chlorination, followed by the removal of excess chlorine by means of a solution of sulphurous acid gas or a sulphite ; this was the process adopted in the large plants supplied to the Army water companies during the war.

De-chlorination could not, however, be applied to the water carts without complicating the process, but as the official doses recommended really amounted to a super-chlorination, if any taste was found after treatment it was usually that of pure chlorine and not the nauseating taste produced by phenol bodies, which the super-dose of chlorine had rendered inoperative.

By means of the test-box it was possible to work out the *minimum* dose of chlorine required for well waters, usually in the neighbourhood of 0·25 part per million, but unfortunately it was just this treatment which sometimes produced the iodoform taste.

Permanganate was employed by Houston as a taste preventer as well as a taste remover, and it may be added before, with, or after the chlorine treatment; the brownish precipitate produced is a disadvantage. Permanganate may also be of great value when the taste is due to algal growths; in doses of 0·25 to 0·5 part per million it completely removed the geranium-like taste due to the growth of Tabellaria. When algal growths are decomposing permanganate is useless, and the only remedy appears to be activated carbon.

In 1910, Rideal suggested the use of ammonia and chlorine for sterilization and the prevention of taste troubles. Race, Harold and Adams have published papers on this method which Houston considers to hold the field at the present time. The treatment can be applied in two ways. In one method the ammonia and chlorine are brought together in a minor volume of water and produce a monochloramine or dichloramine compound. The product is added to the water in bulk. The proportion of ammonia to chlorine recommended is usually 1 to 4 and 1 to 8. In the second method the ammonia is added *first* to the whole body of water to be treated, and then the chlorine. Both methods are usually most successful as regards sterilization and the prevention of taste troubles, but according to Houston there is a *lag* in the full sterilization effects which in certain circumstances is an advantage, in others the reverse.

This lag may be of importance when the water has to be used immediately after treatment. In cases where the consumers receive a freshly chlorinated water, Houston "advocates the adoption of a procedure contrary to the usual sanitary principles, namely, the drinking of cistern water instead of water direct from the rising main."

The procedure followed at the Walton Works may be taken as representing the most modern method of treating one of the London supplies. *Raw* Thames water is first stored in the Walton reservoirs, then filtered, without a coagulant, though primary filters at an average rate of 130·7 gallons per square foot per hour. The next process is filtration through secondary sand filters at an average rate of 5·63 gallons per square foot per hour; this is a higher rate than is customary for slow sand filters. Finally, the water is treated first with ammonia and then with chlorine. The *raw* Thames water contained *B. coli* in 1 c.c. of 89·1 per cent of the samples examined. The chlorinated water from the general filter

well contained no *B. coli* in 100 c.c. in 95·5 per cent of the samples submitted for examination. It was noted that the wash water required for the primary filters was only 0·661 per cent and for the secondary filters 0·065 per cent. In the secondary filters, on the average 320·7 million gallons were filtered per acre cleaned. A remarkable result.

Houston found that storage alone reduced the excremental microbes 96·7 per cent at Walton Works. Storage may, however, lead to the undue development of algal and other growths. Deep reservoirs, with sides which do not slope too much, clean bottoms and good circulation keep the excessive growth of algæ in check. Copper was used by the Metropolitan Water Board in 1907 to combat a growth of oscillaria, and has been employed on numerous occasions since, both as a preventive and curative measure. The results have not always been good, and Houston does not wholly approve of the treatment if it can be avoided, because sometimes the destruction of one kind of growth seems to pave the way for the growth of others of a much more objectionable kind. Further, there is the chance that the algal growths may become inured to copper, calling for progressively increasing doses of the chemical. Chlorine has been tried, but it is not a good algicidal agent. The investigations carried out at Barn Elms showed that primary filters worked at a very high rate could remove most of the algal growths from a stored water, and this led the Board to adopt the principle of a double filtration process and to construct the necessary works at Barn Elms, Walton and Kempton. The result has been a great saving in capital and working costs.

In 1912 Houston introduced the excess lime method for softening, purifying and sterilizing water. He points out that the ordinary lime-softening process is so arranged as to prevent any true bactericidal action taking place, by accurately treating the *whole* of the water with less than the amount of lime required to combine with the bicarbonates, so as to form the insoluble and bacteriologically inert carbonate of lime. In the excess-lime method the water is purposely overdosed with lime to bring about a bactericidal effect. The bactericidal dose is 1 to 2 parts of CaO per 100,000 parts of water. The excess lime may be removed in a variety of ways, but carbonization by CO_2 gas is perhaps the best method. The results obtained were very successful, and the reason why the process has not been adopted for the purification of London water is the cost of the treatment.

The excess lime method has passed the laboratory stage. The Southend Water Works Company has opened a plant, which cost over £1,000,000, for the treatment of raw water taken from the Rivers Chalmer, Ter and Blackwater by the excess-lime process. The water is extremely hard and contaminated. The plant is working well and is designed to supply 7,000,000 gallons of purified and softened water a day. *B. coli* have not been found in 100 cubic centimetres of the treated water, and the hardness averages 10 parts per 100,000.

Houston states that he used to think that the discharges of birds, fish

and the lower animals, although sentimentally objectionable, were relatively harmless in a disease-producing sense. He has modified this view to some extent since Adams discovered *B. typhosus* in the droppings of gulls at Belfast, though this discovery has not yet been confirmed in the case of London gulls. The droppings of gulls contain at least a million *B. coli* per gramme, and it is impossible to distinguish these from those derived from human beings. Gulls are thus a great source of embarrassment to the bacteriologist in drawing conclusions as regards the safety of a water. Houston thought a study of bacteriophages might help, but the investigations proved disappointing, as by their use it was found impossible to distinguish between the coli of human beings and those derived from birds and the lower animals.

Sterilization of water by the action of metals has attracted a good deal of attention lately. Recently the sterilizing action of silver has been studied by Degwitz, Krause, and others, and they have obtained a very spongy form of the metal which Krause calls " katadyn."

In 1929 Lakhowsky immersed silver spirals in the water to be treated, and *B. coli* and pathogenic organisms vanished after several hours. If the spiral was removed the water still remained germicidal, but lost this property on filtration through a Chamberland filter. Lakhowsky considers that the results are due to a physical action, viz., that the spirals alter the frequency of the cellular vibrations which are supposed to exist in the interior of cells.

Sand silvered by the process of Kayser has been tested by Dienert, who found that Seine water containing 46,000 microbes per cubic centimetre was rendered sterile by half-an-hour's contact. The disappearance of *B. coli* is still more rapid ; they could not be found after several minutes. Water which has passed through silvered sand contains less than 0·003 milligram silver per litre and yet retains a certain bactericidal power. When mixed with an equal quantity of ordinary water containing 27,000 *B. coli* per cubic centimetre, the bactericidal action reduced the *B. coli* to 500 in one hour, to 20 in three hours, and to 0 in forty-eight hours. The work of Drs. Beale and Suckling on the action of catadyn sand leaves no doubt as to the efficacy of the process. The water to be treated must be quite clear and not in such a condition as to coat over, and so render inoperative, the particles of sand.

Houston has made a few experiments with catadyn sand and obtained good results. Unfortunately the sand is expensive, which militates against its use on the large scale, but he thinks that for household purposes the catadyn treatment of water would seem to have a considerable future.

In last year's report Houston recounted his experiments to discover pathogenic organs in *raw* river water ; this year his experiments have dealt with sewage. Average samples of crude sewage were collected at the Barking outfall hourly during twenty-four hours and then mixed proportionately to the flow. Wilson and Blair's glucose bismuth sulphite medium

was used; Houston thinks it is much the best medium for the purpose. The sewage was divided into two portions, A and B. A was not infected; B was purposely infected with definite numbers of typhoid bacilli. In 34 experiments with A the typhoid bacillus was recovered only on four occasions, though as many as 200 colonies were examined in most of the experiments, and 5,624 colonies were examined during the investigation. In 34 experiments with B, the infected sewage, the typhoid bacillus was recovered on every occasion, although the number of bacilli added in one experiment was only 11 per 0·1 cubic centimetre. The results seem to indicate that the bacteriological standards for potable waters provide a larger margin of safety than would otherwise have been supposed.

Search was then made for paratyphoid B in separate samples of sewage, because Allan, and later Gibson and Begbie, found paratyphoid organisms in Edinburgh sewage. Houston never recovered the paratyphoid B from the non-infected sewage, but from the infected sewage he recovered it in each experiment, though the number of bacilli added on one occasion was only 50 per 0·1 cubic centimetre.

Since writing the notes on these experiments, Houston has had the opportunity of examining the sewage effluent (land treatment) from a town during a paratyphoid B outbreak. The picture here presented was totally and almost unbelievedly different, and enabled him to visualize how easily an epidemic might arise from the contamination of a drinking-water supply with even traces of such a liquid. The effluent was found to contain initially seventy-three paratyphoid bacilli per cubic centimetre, and the infection persisted for months.

The value of the streptococcus test for waters has been a debatable subject for many years. In 1898-99, and in subsequent years, Houston reported to the Local Government Board on the significance of streptococci. He wrote that "Some fæcal streptococci are of feeble vitality, and that the presence of such streptococci in the water, if they could be differentiated from their more robust companions, would seem to indicate pollution of recent and therefore specially dangerous sort."

A good deal of work was done on fæcal streptococci, but without any very definite solution of the problem of *recent* contamination of a potable water by means of the streptococcal test.

The *B. coli* test came to be regarded as the easiest and most delicate method of judging excremental contamination of a water supply. If streptococci fermenting lactose were discovered during the ordinary examination, their presence was considered merely as confirmatory evidence of fæcal contamination.

A lactose bile-salt medium favours the growth of *B. coli*, and to a much less extent that of streptococci, at the expense of most other organisms. As a result coli colonies are apt to crowd out those of streptococci on Conradi-Drigalski plates. But Houston has found that if the growth in the liquid lactose bile-salt medium is spread on a plate and dried in a *moist* chamber,

the streptococci are more resistant than the coli, which are killed. He spreads a few drops of the liquid medium in a thin film on the bottom of Petri dishes. The dishes with the covers raised are put in a *dry* incubator at 37° C. for fifteen minutes to dry the liquid on to the glass; they are then transferred to a *moist* incubator (eighty-five per cent humidity) for about three-quarters of an hour. Next, thirty to forty centimetres of melted agar are poured into the dishes, which are incubated at 37° C. Almost a pure growth of streptococcus colonies will be found on the under surface of the agar next the glass.

When examining water in baths and bathing pools, as it is necessary to determine the presence of salivary as well as fæcal streptococci ordinary agar must be used, as the Conradi-Drigalski medium inhibits the growth of salivary streptococci. If streptococci are found with long chains which ferment lactose but not salicin, they are probably of salivary origin. Salivary streptococci, unlike fæcal streptococci, form relatively long chains and are easily detected even when the amount of saliva added to a *raw* water (Thames water) is as small as one part in 1,000,000 parts.

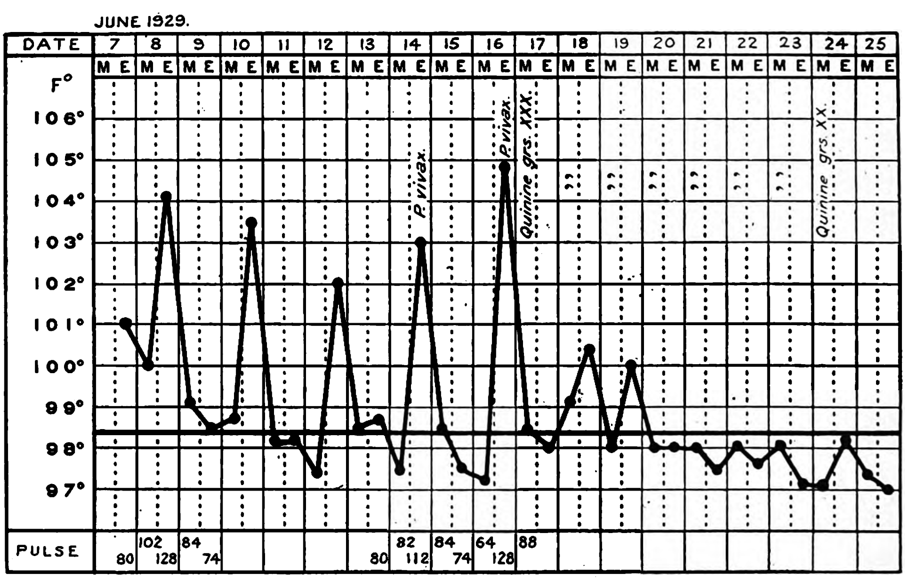
The streptococcus test is undoubtedly useful in examining the condition of water in baths, and is also valuable as a corroborative test of fæcal contamination, but it cannot tell us whether a water has been recently contaminated, nor can it at present help us to differentiate between human and animal pollution.

Clinical and other Notes.

A CASE OF ENGLISH MALARIA.

By Brevet Lieutenant-Colonel R. C. PRIEST,
Royal Army Medical Corps.

For a considerable period subsequent to the Great War, many cases of malarial fever were reported from various parts of England and it was a logical conclusion that these were due either to relapses of the infection contracted by soldiers who had served abroad or to the transmission of infection to others who had never left these shores. By 1929 most of these carriers and those infected from them must have become malaria-free and so the occurrence of malaria in 1929 in the case of a soldier who had never been out of England, who had never shared a tent, room or mess-room with any sufferers from malaria and whose immediate friends had never been abroad, seems to me worthy of note. Corporal of Horse L., aged 37, was admitted



to the Queen Alexandra Military Hospital on June 13 with a history of being perfectly healthy all his life until June 6 when he had a rigor with shivering followed by heavy perspiration. He was admitted to the Household Cavalry Hospital, at Windsor, on June 7. Rigors occurred in regular sequence on the 8th, 10th and 12th, and on the 13th he was transferred to London as a case of malaria. He had up to this time received no quinine. On the 14th

the fifth rigor appeared and a blood-film taken during the paroxysm showed the *P. vivax*. The spleen was enlarged and easily palpable. Quinine bi-hydrochloride in doses of 10 grains thrice daily was administered to which the fever quickly responded. The summer of the year in question, it will be recalled, commenced early and continued to be very warm and was most suitable to the development and propagation of the mosquito. The patient, who had been stationed at Pirbright before proceeding to Windsor, said that he had spent many evenings near the Basingstoke Canal at the former Camp and on the river Thames at Windsor. The copy of the temperature chart reproduced demonstrates the typical features of benign tertian fever and the rapid effect of quinine administration.

CARE OF THE SOLDIERS' FEET.

By Captain C. MARTIN ROW,
Royal Army Medical Corps.

Sore feet as the result of marching with full equipment is of such vital importance in the Army that any satisfactory method of treatment cannot fail to be welcome.

I have given a prolonged trial to the powder called silantox. This powder is very finely divided amorphous silicon dioxide. It is quite cheap, being only 4s. a lb. I find that it is a great help in preventing sore feet, and a very useful remedy when the condition already exists. If it is to be used as a preventive measure, the feet should be treated for at least a month before long marching takes place. The treatment is simple. The feet must be washed with cold water once a day and carefully dried. The socks must have no holes and should be sprinkled inside with the powder. Needless to say, the boots must be well fitting and properly greased.

For some weeks before the recent concentration the Infantry Brigade, of which I have medical charge, carried out this treatment of the men who were known to have sweaty feet and also of men whose feet had broken down at an early date on divisional exercises in the preceding year.

It was found that the improvement was well marked, the men reporting with sore feet being much fewer than those treated in the usual manner. It was also noticed that in cases where the skin had been rubbed off blisters the resulting sore places did not tend to become septic, and no man had to be admitted to hospital.

As is well known, no method of foot treatment is of any use if it is not properly carried out. It is therefore necessary to get the officers and N.C.O.'s interested and keen in the care of their men's feet. This is best ensured by giving them one or two lectures and showing them cases of varying degrees of sore feet, and then demonstrating the best method of treatment in each case. As a result of these lectures, the Infantry Brigade

referred to has shown great interest and has taken much trouble to see that my recommendations have been properly carried out.

Each company has a man trained in the routine of foot treatment, who carries a small box containing iodine, picric acid, potassium permanganate, silantox, zinc oxide plaster, gauze, and a few bandages, and when a man falls out on the march he treats him at once in the following way: If the surface of the skin has already become broken, he paints it with iodine and applies zinc oxide strapping direct to the sore place, sprinkling the inside of the sock with silantox. If there is only a blister, he first pricks it and then treats it in the same manner. At the end of the march he examines the feet of the company in the presence of an officer, and treats them as above, only the worst cases being seen by the medical officer. There are frequently many small abrasions on the feet. These are treated with silantox only.

I think the advantage of the powder over those generally used is that it gives a very high gloss to the skin, allowing the sock to move freely over it, and that it helps to cure excessive sweating of the feet. It is also a mild antiseptic and healing agent.

When zinc oxide plaster is applied to the sores and dusted with silantox the plaster does not wrinkle up, owing to the gloss on the surface of the plaster. I think this is very important, as the wrinkled plaster frequently turns a mild abrasion into a severe one. I consider ordinary plaster should never be used. It is quite surprising to see how easily a man will complete the day's march after his sore feet have been treated by the above simple method. I have also found this powder very efficient in the treatment of saddle sores, so common in cavalry recruits.

It has been suggested to me that the use of civilian boots, at present worn by the soldier when off duty, might be the cause of the feet not getting properly hardened. I do not think this is so, as N.C.O.'s all wear civilian boots off duty, and the percentage of sore feet amongst them is much less than in the private soldier in spite of the fact that a large number of the privates do not possess any boots except those issued to the Service. Also many officers wear regulation boots for long marching, and sore feet are very rare amongst them.

I have not entered into the subject of the usual causes of sore feet, such as badly-fitting boots, boots not properly softened, socks with holes and badly shrunken in the wash, as they are too well known to call for any comment. There can be no doubt, however, that the present extremely hard and polished condition of the modern roads is a powerful predisposing cause.

In conclusion, I would say that, in my opinion, there would be fewer sore feet if the soldier did more marching with full equipment. The modern method of organized games and regimental gymnastic exercises makes a man very fit, but games and exercises in no way harden his feet, and in war it is no good having a highly trained and fit army if the men cannot march.

SOME FIGURES ON THE EFFECTS OF SMOKING ON ENDURANCE.

By Major T. F. KENNEDY, O.B.E.
Royal Army Medical Corps.

The figures given below are the result of observations stretching over nearly seven years, during which period approximately 2,000 men have been tested. They are based on the result of the three-mile cross-country run held at the conclusion of each Physical Training Assistant-Instructors' Long Course at Aldershot.

The men are categorized into heavy smokers (twenty cigarettes, or equivalent, taken per day), moderate (anything under twenty cigarettes per day), and non-smokers.

Number of men observed, 1,973, in twenty tests.

Class of smoker	Heavy	Moderate	Non-smoker	Total
Total in each class	167	1,461	345	1,973
In first 10 places	10	125	65	200
Percentage of each class in first 10 places	6·0	8·6	18·8	—
In last 10 places	19	167	14	200
Percentage of each class in last 10 places	11·4	11·4	4·0	—

The figures show that the percentage of non-smokers getting placed in the *first* ten is three times that of the heavy smokers and, on the other hand, the percentage of non-smokers in the *last* ten places is approximately one-third of that of the heavy smokers. This constitutes a very strong case against smoking where staying powers are required.

One criticism offered to these figures was that the N.C.O.'s at this school, being keen on physical culture, might be rather faddy about smoking, and thus give results which might not be true of a general Army population. Observations were therefore carried out on one of the infantry brigades at Aldershot, the men being categorized in exactly the same manner as at the School of Physical Training. The results definitely support the school figures.

Observations are being carried out on the same lines on sprinters; the numbers observed are still too few for any reliable deductions to be made, but a point of interest that strikes one in the figures already available is that heavy smokers do not seem to suffer the same disadvantage as they do in the endurance test.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (*Ret.*).

(*Continued from page* 390.)

We were now approaching the region of precipices, and terrible they were. It was a bold piece of engineering that cut the road on the face of these immense cliffs. The road was about six feet wide and hewn out of the solid rock. The cliffs are called the Mesang cliffs and the larger group the Rogi cliffs. The sheer fall from the road to the river at the Mesang group was 2,635 feet, and at the Rogi cliffs, which we had just reached, 3,460 feet. My wife was really scared and I did not like the prospect of taking the horses along them. However, we started again and for a long way our track was on this narrow path with the roaring Sutlej rushing over the rocks nearly 4,000 feet below us. We were much relieved when we left these fearful precipices behind us.

At the bottom of the gorge and by the river we could distinguish Kilba, the headquarters of the Forest Department, controlled by Mr. G. G. Minneken. He had been there eighteen years and was probably better acquainted with this district than any living Englishman. There is a Mission here, visited annually by a Roman Catholic priest, and also some Moravian Missions farther on at Pooi.

We had one more sweep of road through pines, cedars and deodars, and soon reached the Rogi dak bungalow. This was a small house perched on a spur at 10,000 feet. We were on a precipice, with a still greater one opposite separated from us by a small mountain stream. On our right front and directly before us stood the immense cliffs leading up to the glaciers of Kailas and Raldang. They were some distance away but seemed very near.

We had not yet finished our cliff experiences, and our route now lay along a narrow ledge with a straight fall of 4,000 feet from the edge. At one point the road had broken away, leaving only about three feet for the crossing. It really was terrifying, but we were getting accustomed to this feature of the roads. We were piloted safely by hillmen over this bad part, and our horses also. Round and round, and in and out, we bent our way, and suddenly emerged on to the most beautiful stretch of green sward, three or four miles long and one mile wide at the broadest part. This was Chini, which means "sweet," like sugar, and it was sweet and pleasant after our recent severe marches. Chini lay on a very gradual slope to the west,

while directly opposite rose the immense mountain of Raldang with the peak of Kailas still higher behind. Flowers of all kinds grew in profusion, and my wife found some edelweiss. Here we entered the area of western Buddhism. The little village of Chini consisted of one street and contained the first Buddhist temple we had noticed. There was nothing striking in the temple, nor did I notice any good folk going to church, as they should.

There were many other reminders of Sakyamuni present, and I noticed large and small heaps of stones inscribed with the initial letters of the word, "Om Mane Padne Om," which means "*Hail! Glory of the Lotus, Hail!*" I saw some pillars and wooden uprights with these symbols, which must always be passed with the right hand next to the pillar. Consequently, if the pillar is on the right side of the path passing is an easy matter, but it might not be so easy on the return, and then it might be necessary to go off the road in order to comply with this Buddhist obligation. Usually a small track marks the direction. We met Buddhists walking along and carrying small spinning prayer wheels. These are cylinders through which a stem is fixed to a handle. The words are turned round the stem and signify a proportionate degree of grace. Then we saw prayer wheels so arranged that by turning on a stream of water many cylinders could be worked. Sometimes the stems of prayer wheels are furnished with fins, and when placed in water are turned by the force of the water. I shall describe the largest we saw at Rampur later. I climbed to 14,000 feet, and was successful in obtaining a snap of the mountain of Kailas, for just as I was ready the clouds rolled back and disclosed the graceful peak. It stood out prominently for a minute or two and then the mists once more enveloped it. The movements round these peaks are very striking. At one moment all seems quiet, and then suddenly in an uproar of tempest. The force of the wind must be great, as on most peaks a streamer of snow is to be seen blowing from them. Kailas means "Heaven," and this is a most appropriate name for this slender peak. Kailas is 26,000 feet in height.

Raldang, which I have already referred to, lies a little lower than Kailas and is about 22,000 feet high. I cannot give the meaning of the name, but "*ral*" means foam or saliva, and "*dang*" means tumult or uproar. The name is suggestive of the gales and storms on the highest part. The summit is of a dome shape on a very broad base, and this makes it show rather different colour effects at a distance, such as we noticed at Taranda when it appeared as a mass of pure gold. The mountain rises sheer from the Sutlej, 4,000 feet below, and passes straight up for a long distance, so that I should guess the precipice here to be 10,000 or 12,000 feet.

There is a third peak of 19,000 feet high, and known as the Castle or Baspar. Its appearance justifies its name. Baspar means strong scaffolding, or support, in the local dialect.

Lord Dalhousie, Viceroy of India in the fifties of the last century, was anxious to make Chini his summer residence. Here he found rest from

the strain of his work; here was the calm before the storm, for the time was close on the outbreak of the Mutiny. The distance, however, from India precluded the idea of ruling from Chini.

We were sorry to leave the place and its sweet air, but it was necessary to keep to our itinerary punctually, so after breakfast the next morning we strolled away on a short march to Pangi, which would be the limit of our journey in this direction. The path lay down a gentle incline towards a point where the mountains seemed to close in and meet each other.

It was very calm and sunny as we marched, and the persons we passed nearly all carried prayer wheels which they kept spinning in their hands. At one place we found a big prayer wheel worked by water, the water power was also coupled on to smaller wheels. Contributing some money, we were regaled with a circle of prayers. The natives here showed a more Mongolian type of face and appeared well fed and healthy. They were very short and broad, which I attribute to the heavy weights they have carried for centuries. We entered a pine forest and found Benjamin making our lunch. Later we emerged from the pines and turned sharply up hill to Pangi which was now in sight, and soon reached the rest house. Pangi lies on the sheltered side of the hill. For more than six months in the year this village is under snow. The dwellings are rather close together, and I noticed many cases of blindness and ophthalmia, and wondered if they would ever be free of this plague. A community that practically hibernates half the year, and under snow the greater part of that time, depending on its store of grain and apricot oil, must frequently be severely strained for existence. Infective disease also must make a holocaust of them on some occasions.

The rest house is in the middle of the village and rather above it. It looks directly on to the snows of Raldang, while to the left is the route to Tibet and China. In the dining-room there is a round table of a large size upon which are cut the names of many Viceroys, Commanders-in-Chief, Members of Council and others. I remember seeing the name of Lord Roberts, cut about the time of the Mutiny and when he was just on the first rung of the ladder of fame.

I walked a short distance from the rest house and reached a point where I could see down to the river and for a few miles along the gorge below the bridle path leading to Tibet, now only a march or so away. There was a confusion of immense rocks lying "higgledy-piggledy" and forming the most weird shapes and figures. Far down and over 3,000 feet below roared the river, and this noise ascending was affected by the wind causing the most deafening and terrible sounds.

As I was returning, I saw a procession carrying a remarkable looking figure along the hill-side, and accompanied by cries and chanting, with an interminable beating of "crack-pot" sounding drums. This noise echoed all round and the natives crawled out of the earth to see the figure as it passed to its temple, where it was deposited. It was the goddess

Parbutti. This lady had been taken out to propitiate Jupiter Pluvius and invite him to come to them and water their crops, which were parched in the dry heat. Parbutti was a weird, uncouth object, composed of a wooden block with an ugly female face, suggestive of a "Gorgon," and covered with yak's tails. Now Parbutti in the flesh was the well-favoured of Krishna, and we gather from mythological history that she enjoyed a very good time in the Elysium of the immortals of the Himalayan Pantheon.

We were sorely tempted to go on towards the frontier of Tibet, and return through Spiti and Lahoul and home through Kulu. I was not clear in my mind as to the nature of such a journey and had to consider my wife, so regretfully turned round and in a few days time returned by the route already described and halted once more at Sarahan, where I had promised to take a photograph of my friend Shumshere Singh.

It was not long after our arrival that His Highness presented himself alone and we asked him in. He gave us the time and showed his watch, and he also drank some tea, which rather astonished us. I suppose, as he could not be seen, he thought he could do as he liked. Later he returned to his palace, after inviting me to a Durbar in the morning, when I should meet some of the heads of the State. He was most friendly and I think imagined that I was a much more important person than I was.

The next morning at 8 a.m. I rode up to the palace, and a servant carried my camera. Shumshere Singh met me at the entrance and led me through some wooden corridors into a long apartment. At the top of this two chairs were placed covered with skins. The Rajah handed me to one, and took the other. A lot of uncouth, dirty looking fellows lined up the walls, and some more superior persons (pundits) were in front. One of these made a long speech, of which I could only understand a few words. I think the speech principally eulogized the Rajah; I was given a few words at the end. I had a fairly good flow of Urdu in the *coolie bat*, as the soldiers say, so I talked about the sun in the sky and the Rajah on his throne, and how like they were. The sun gave heat and comfort and life, the Rajah shone with a glory of generous deeds, healing the sick and giving money to the poor. I then suggested that I should take his photograph. He was ready and keen and was evidently anticipating it. Cleanly dressed in white he wore a large turban with a large egret feather fixed with a jewel and looked well, but in reality was a small, insignificant little man, wizened and old, with rather a sinister smile or leer. A chair was placed for him in the courtyard, and when he sat down all the "rag, tag and bobtail" of the place tried to get into the picture. This did not meet with my artistic sense, so I again used the figure of the sun and said, "Rajah Sahib you must be taken alone, as there is only one sun in Bussahir." The effect of my well intentioned remark was for His Highness to sink into his chair in a state of collapse and despair, which I could not understand. I took the picture but it was too unfair to keep it, so I destroyed the plate. The sadness and depression did not pass

away, so I took my leave. The reason for this incident was that he thought I was referring to his "son" who had died of poison the year before, to the old man's grief and sorrow. He escorted me to the gate and I have never seen him since, but I retain a kindly feeling for the old Rajah of Bussahir.

We determined to vary our return march by taking the route through Rampore. This town was the capital of Bussahir and we wished to see it. The road, along which we were able to ride the greater distance, followed the left bank of the river. After a few miles we arrived at the head of a large inland lake in a superb setting of mountains. It looked very placid and I saw no boats on it, but I suspect the current of the Sutlej which passes across it is too strong. Suddenly we reached the Nogri stream which we had to cross by a jhula bridge. This bridge was of a very primitive type and looked old and rickety. It was formed by a thick rope made of fibre and swung from one bank to the other, over wooden uprights, with their ends secured and anchored in the ground. Between the uprights and threaded on the rope was an iron ring with thin ropes attached, so that it could be pulled across from both ends. Two or three strands of rope in the form of a short loop were attached to this ring, and in this the traveller sits, holds on tightly and is hoisted over. My wife firmly declared that she would not cross it, so I went over and back two or three times and tried to give her confidence. Finally she agreed, provided I went with her. We both sat in the loop and I held my wife. Now the usual weight carried rarely exceeds 150 pounds, and here was I started on this journey with 163 pounds on my account and 112 pounds for my wife, or 275 pounds. I had not foreseen this, and the rope sagged and stretched till we were within three or four feet of the torrent. If this had caught us we should have wrecked the bridge and lost our lives. Mercifully the rope held and kept us clear, and we landed safely on the other side. I returned and took the horses up stream a short way; a long rope attached to their necks was taken to the other side to be held by several men. The horses were then pushed in, and as they were carried down the stream, the men pulled the rope and drew them into the side and landed them.

Nirit rest house stands on a small eminence in the valley and just above the bazaar. We had a long march and were tired, so turned in early and slept.

Our next halt was at Rampur. It was an easy march, and I recollect approaching this old-world place and seeing the gallows for criminals standing ominously on the bank of the Sutlej which runs past this town. Rampur is the principal city of the State of Bussahir and Kunawar. Our good friend the Rajah had notified our arrival and had issued orders for our comfort. On the morning of the next day a tall, thoughtful-looking man strolled up the main street to our quarters and salaamed us. He was the State Munshi and spoke English after a fashion all his own, and told us that he kept order and the post office. He supplied me with some very good stamps of the State, which I bought. He was also the State Poet Laureate.

(*To be continued.*)

SOME NOTES ON THE DEVELOPMENT OF THE ARMY MEDICAL SERVICES.[1]

By F. KINGSLEY NORRIS, M.D.,
Melbourne.

REFERRING to the Campaign against the Moors in 1480, Prescott in his "History of Ferdinand and Isabella" wrote :—

> "Isabella caused a number of large tents known as the Queen's Hospitals to be always reserved for the sick and wounded and furnished them with the requisite attendants and medicines at her own charge."

In a letter of the time, Peter Martyn, an Italian scholar, has left this impression :—

> "The camp hospitals of the Queen are so profusely supplied with medical attendants, apparatus and whatever may contribute to the restoration or solace of the sick, that they are scarcely surpassed by the magnificent establishments of Milan."

This is an account of the earliest attempt at the formation of a regular medical service.

William III introduced some form of field ambulance into the British Army, but as Cumberland marched relentlessly north a few years later to crush all Stuart hopes and incidentally the clan system at Culloden, he left behind him many sick soldiers. While most regiments were accompanied by a surgeon, there was no provision of transport or accommodation for the many casualties. The soldier who fell out on the march from fatigue, pneumonia or dysentery, dropped quietly out of sight from the day when he crawled or was carried into some cottage or hovel and there left to recover or to die. Officers fared little better. If the soldier recovered in some way, he regained his regiment or he deserted. If he died and if he was an officer, his name was reported to the War Office, but the name of a non-commissioned officer or private was never reported before 1793; he was included in a nameless number of casualties and he passed away with no further ceremony. Sometimes the local leech would be called in to treat the sick man and would render his account to the Government concerned. Found among the papers belonging to Cumberland's Army is such a bill presented by David Brodie, Physician, of Elgin, for professional attendance on George Recuby, of Cobham's Dragoons (now called the Tenth Hussars), "left in a country village dangerously ill on April 16 (1746)," the day of the battle of Culloden :—

---

[1] Reprinted, by permission, from the *Medical Journal of Australia*, March 14, 1931.

			s.	d.
April 16.	To a bleeding ..	.. ..	1	0
	A box of pectoral linctus	.. ..	1	0
	A pectoral mixture	.. ..	1	6
,, 17.	A glass of febrifuge drops	.. ..	1	0
	A pound of cooling mixture	.. ..	1	6
	A blistering plaster	.. ..		6
	2 lb. of pectoral infusion	... .	1	6
,, 24.	2 lb. of emulsion	.. ..	1	0
,, 25.	Do. repeated ..	.. ..	1	0
,, 26.	The same	.. ..	1	0
,, 30.	4 lb. white decoction	.. ..	2	0
	4 doz. febrifuge powders..	.. ..		9
	To wine to make seck whey, sugar milk, barelay, rice, tea, and other nourishment furnished him from 16 April to 1 May		7	0
	Paying for a coffin and mort cloth and to the grave-digger ..		7	0
			£1 7	9

N.B.—Any cloaths that this man had lyes in a village called Oldmilns; his landlady took his money out of his pocket, which she says was only six shillings, and says she expended it on aquavitæ, which I am persuaded hurt him.

The Peninsular campaign under Wellington would seem to have been served, or rather neglected, along similar lines. Rowlandson's drawing of an invalid officer lying on the floor of a wretched Portuguese cabin attended by his drunken soldier servant is well known. In Spain, Wellington lost ten times as many men from disease as from battle, and more in one winter's encampment without any fighting than in the whole of the previous summer's campaign.

There is a popular tradition that Napoleon's ghastly defeat in the final Russian campaign was due to the devastation of the country by fire and sword allied to the snows of Generals January and February. In spite of the historical snow-clad pictures of that retreat, his army crossed the Beresina in November. A raging storm of typhus contributed to the decimation of the army, and again it was pestilence, not powder, that decimated his army at San Domingo and prohibited any attempt at an American invasion.

In the ground of the Royal Army Medical College facing towards the Tate Gallery is a weather-stained statue to Sir James McGrigor. The gentleman of this stalwart name filled the office of Director-General of Medical Services for some thirty-six years continuously until he retired from the Service about 1850 with the vision of an Army Medical Corps unrealized.

And so things muddled along until the time of the invasion of the Crimea in 1854. It is necessary to dwell on the Medical Service of this campaign; it was the turning point in the history of our organization. Surgeon Sir A. D. Home has written a delightful reminiscent book, "Service Memories." As a young man he went to the Crimea as a regimental surgeon. Later he was to win the Victoria Cross in the Indian Mutiny. Conditions had improved since Waterloo. One bell tent was allotted to each regiment for hospital needs, but there was no medical

equipment. The sick men lay on the ground; if they had their coats, they were covered; if their coats were lost, they shivered. There was no special wheeled transport for wounded in the whole of the war area. The Army originally possessed two four-wheeled wagons to serve the needs of the wounded, but on embarkation at Varna, some officers' horses were considered to have prior claim to the deck space and the wagons were bundled on shore again; there they remained and rusted through the campaign. I think we have all met those officers. General Home witnessed the memorable charge of the Light Brigade. The first Victoria Cross awarded to a medical officer was won by Surgeon Mouat of the Sixth Dragoons, on this occasion for distinguished gallantry in "dressing the wounds, arresting hæmorrhage, and thus saving the life of Major Morris in a very exposed position in front of the enemies' guns just after the charge." The Light Brigade was fortunate in possessing two folding canvas stretchers carried by the farriers in front of them as they rode. It was months after the war began, after the Battle of Alma, before more than one thousand beds were provided at the base Scutari, the Asiatic suburb of Constantinople. It is impossible to dissociate the base hospitals at Scutari from the name of that gracious Lady of the Lamp, Florence Nightingale. After tremendous opposition from the War Office, Miss Nightingale was sent out more or less officially to play at nursing the sick soldiers. To quote rather lengthily from Lytton Strachey's cameo of this lady in his "Eminent Victorians":—

> "At Scutari, the landing stage, constructed with all the perverseness of Oriental ingenuity, could only be approached with great difficulty, and in rough weather not at all. When it was reached, what remained of the men in the ships had first to be disembarked, and then conveyed up a steep slope of a quarter of a mile to the nearest of the hospitals. The most serious cases might be put upon stretchers—for there were far too few for all; the rest were carried or dragged up the hill by such convalescent soldiers as could be got together, who were not too obviously infirm for the work. At last the journey was accomplished; slowly, one by one, living or dying, the wounded were carried up into the hospital. And in the hospitals what did they find? Want, neglect, confusion, misery—in every shape and in every degree of intensity—filled the endless corridors and the vast apartments of the gigantic barrack house, which, without forethought or preparation, had been hurriedly set aside as the chief shelter for the victims of the war. The very building itself was radically defective. Huge sewers underlay it, and cesspools loaded with filth wafted their poison into the upper rooms. The floors were in so rotten a condition that many of them could not be scrubbed; the walls were thick with dirt; incredible multitudes of vermin swarmed everywhere. And enormous as the building was, it was yet too small. It contained four miles of beds, crushed together so close that there was but just room to pass between them.

> Under such conditions, the most elaborate system of ventilation might well have been at fault; but here there was no ventilation. The stench was indescribable."

"I have been well acquainted," said Miss Nightingale, "with the dwellings of the worst parts of most of the great cities in Europe, but have never been in any atmosphere which I could compare with that of the Barrack Hospital at night." The structural defects were equalled by the deficiencies in the commonest objects of hospital use. There were not enough bedsteads; the sheets were of canvas, and so coarse that the wounded men recoiled from them, begging to be left in their blankets; there was no bedroom furniture of any kind, and empty beer-bottles were used for candlesticks. There were no basins, no towels, no soap, no brooms, no mops, no trays, no plates; there were neither slippers nor scissors, neither shoe brushes nor blacking; there were no knives or forks or spoons. The supply of fuel was constantly deficient. The cooking arrangements were preposterously inadequate, and the laundry was a farce. As for purely medical materials, the tale was no better. Stretchers, splints, bandages—all were lacking; and so were the most ordinary drugs. Miss Nightingale came, and she, at any rate in that inferno, did not abandon hope. So dreadful was the neglect of efficient medical services that in two years 1,700 men were killed or died of wounds, while 17,000 died of disease, one to ten. Cholera alone accounted for 4,500 deaths. Florence Nightingale returned to England, and her heroic and lonely fight against this disgrace dragged on. Her notes affecting the health, efficiency and hospital administration of the British Army comprise eight hundred closely written pages. She was directly responsible for the establishment of the first Army Medical School at Netley. She struggled and fought fiercely against dreadful opposition, but she won through and laid the foundations of all our modern Army medical organization. The foundation charter of the Royal Army Medical Corps was embodied in a Royal warrant issued in 1857:—

> WHEREAS we have deemed it necessary to constitute a new corps of attendants in our military hospitals for the better care of the sick and wounded soldiers of our Army, our will and pleasure is that a corps shall be forthwith raised for this purpose.
>
> By Her Majesty's command,
>
> PANMURE.

So, strangely, we owe our medical service to two women, the energetic, martial Isabella of Castille, and the inflexible Florence Nightingale.

The first concrete improvement was the sending out of London's most famous chef of the day, Monsieur Soyer. One can imagine this autocrat of Piccadilly instructing the regimental cooks in dealing with the Army food of the time. He has left his name with us to this day in the Soyer field oven.

The Geneva Convention in 1864 was the direct outcome of the Crimean Campaign and the battle of Solferino.

The old order or disorder rapidly changed. In the list of officers attached

to Kitchener's Staff in the Sudan Campaign we note the Medical Service has two representatives, Surgeon-General Taylor and Lieutenant-Colonel Gallwey, and each brigade had its own Principal Medical Officer.

In the South African War the Medical Service was highly organized, but the Cinderella of the Army, the hygiene service, was well in the background, or rather right out of the ground altogether. As a result the deaths from disease still greatly outnumbered the deaths from wounds, but the Field Ambulance as organized to-day is a creation of the South African War.

The importance of Army hygiene had to wait another two years for recognition, and of all lessons from the Russo-Japanese War none is more impressive than the results of the first attempt at organized army sanitation. The whole Medical Service of the Japanese Army was interesting. Each battalion had two medical officers, but there was no brigade service. Each division possessed one bearer battalion, five hundred to six hundred strong (six per cent. fighting troops) under the charge of an infantry major, which carried wounded to the various aid posts and dressing stations. Attached to each division was a sick and wounded transport department under an infantry major, for transport to the divisional hospitals. There was one dentist to each army. In quarters or on the lines of communication all drinking water was boiled in large rice cauldrons. In the field alum and lime were generally used. Through the campaign there was at least one monthly lecture to all troops on sanitary precautions, and every officer and man as a routine three times a day with his meals took a creosote pill containing one and a half grains of creosote as a prophylactic against intestinal disease. As a result of these various measures the ratio of deaths from disease to deaths from wounds fell to 0·3 to 1, a fraction for the first time in the history of the world. The Russian Medical Service was almost Gilbertian in many respects. The chief medical officer of the Russian Army was the Adjutant-General, and there was complete separation between the administrative and professional duties. Doctors were only doctors, not soldiers, and had no disciplinary powers. The Red Cross Service played a large part in providing the medical personnel, and there was gross lack of co-ordination between this organization and the Army Medical Service. In the course of the campaign one dentist was appointed to the armies, but on second thoughts his appointment was cancelled and a meteorologist was sent out instead. However, his prognostications proved no more reliable than those of his kind and he was recalled.

Many are familiar with the medical organization in the Great War, but few have realized what was achieved. Gustavus Adolphus once broke camp and started on his spring campaign two months earlier than he had intended, simply for fear that, if he waited in camp until summer, he would have no army left. Our armies in Flanders and northern France in the winter of 1917-1918, in open trenches in the vilest weather, had less sickness and fewer deaths from all diseases than soldiers used to have in barracks in time of peace and far less than the civil population at home. According to the

prevalence of typhoid fever in previous campaigns we should have had 20,000 deaths a year on the British western front alone. Actually during four years among 3,000,000 men there were only 260 deaths. Such was the team work of surgeon, ambulance and nurses that of the wounded who reached the base 98 per cent recovered. On the standard of the Crimean campaign, barely sixty years previously, the medical organization of the Great War resulted in the magnificent saving of at least 400,000 lives yearly.

I am indebted to the assistance of Colonel R. M. Downs in the preparation of these notes.

Current Literature.

MAZZA, S., AND ARANDA, C. A. Fouadin in American Leishmaniasis. *Arch. f. Schiffs- u. Tropen-Hygiene*, 1931, xxv, 583.

The authors discuss some of the remedies used at present in the treatment of dermal leishmaniasis and consider that none of these is ideal. They were led to try Fouadin (Neo-antimosan), a trivalent antimony preparation, when they became aware of the ease and safety with which it is employed in Egypt for schistosomiasis.

They state that they have now treated numerous cases of dermal leishmaniasis by intramuscular injections of Fouadin and that all have done well with no recurrences, and no ill-effects have been seen.

They describe three cases, all treated in the Argentine. The first patient was a male, aged 25, who had on the lower lip an ulcer about four centimetres in diameter. Leishman bodies were found in large numbers in smears. Intramuscular injections of Fouadin were begun with three daily injections, first 1·5 cubic centimetres, then 3·5 cubic centimetres and 5 cubic centimetres, followed by an injection every other day of 5 cubic centimetres.

Thirty-two injections were given in just over two months, with a break of eight days, during which an attack of malaria was treated by quinine injections. The patient was a latent syphilitic. At the time of the tenth injection, seventeen days from the beginning of treatment, the ulcer was only half its original size.

The final scar was smooth, uncontracted and scarcely visible, in contrast with the usual scar after tartar emetic treatment, which is thick and inclined to contract.

The patient's general condition improved during the treatment, and he suffered no inconvenience from the injections.

The second patient was an Argentine boy, aged 9, who had suffered for at least four years with ulceration of the face. When the patient was seen there was a large mass of ulceration in the region of the left eye, the

nose, the cheek, the upper and lower lips and the palate. There was a considerable loss of tissue on the left side of the nose. Scrapings from many parts showed Leishman bodies. On the left temple there was an ulcer of typical leishmaniasis character. Stibosan injections were given, one of 0·05 g. and four of 0·1 g. intravenously, then two of 1 g. intramuscularly, as it was difficult to find veins. The intravenous injections were well taken, but the intramuscular ones were very painful. Fouadin treatment was then adopted, and ten intravenous injections were given, beginning with 0·5 cubic centimetre, 1·5 cubic centimetres, and 3·5 cubic centimetres, one every day, then seven injections of 3·5 cubic centimetres, one every other day.

There was considerable improvement by the end of this series of injections. Treatment had to be stopped for one month, as the patient developed measles. During this time there was no set back, which the authors say is not the case in tartar emetic treatment, as with it an interruption is usually followed by the appearance of fresh lesions or an exacerbation of healing ones.

A second series of Fouadin injections, similar to the first one, was given, at the end of which, about three months from the beginning of treatment, all the sores had healed with very good surfaces.

The third patient was an Argentine male, 17 years old, anæmic, and with the Wassermann and Kahn reactions positive.

There were one large and two small ulcers on one of his shins; they were of some months' duration. Leishman bodies were numerous in serum obtained from the ulcers.

A course of ten Fouadin intramuscular injections was given in the same manner as in the first case. The patient had to leave hospital and was given seven ampoules (0·5 cubic centimetre in each) for home treatment. He was seen later and the ulcers were completely healed.

In a summary the authors state that Fouadin is superior to tartar emetic and the pentavalent antimony preparations in the rapidity of healing of the sores and in the fineness of the scar. They also say that the new remedy is especially suitable for children on account of the ease of its administration and the absence of toxic action.

The article is illustrated by eleven clear photographs.

GUNN, H. AND HOWARD, NELSON J. **Amœbic Granulomas of the Large Bowel. Their Clinical Resemblance to Cancer.** *Journal of the American Medical Association*, 1931, xcvii, 167.

The authors give short notes on cases in literature in which amœbic conditions have given rise to tumours which, in several cases, were diagnosed as carcinoma.

They then describe three cases which occurred within six months in California. The first patient was a male, aged 39, who contracted amœbic dysentery in the Philippine Islands in 1916, from which time there had been

recurrent attacks of diarrhœa and almost constant anti-amœbic treatment till 1929, when the diarrhœa became less but severe abdominal pains developed at frequent intervals mostly in the upper left quadrant of the abdomen. In January, 1930, many forms of examination were employed, but the only positive finding was some obstruction of the left ureter close to the kidney. This obstruction was dilated, but later an instrument could not be passed. In February, 1930, the abdomen was opened and a large tumour, considered to be a carcinoma, was seen at the splenic flexure of the colon. It was not interfered with, but a gland near the tumour was removed and on microscopical examination it was found to show only inflammatory changes.

It was considered later that the condition might not be malignant, and the stools were carefully examined for amœba and after prolonged search, cysts of *Entamœba histolytica* were found; they had previously been found by one of the writers in 1919 and 1926.

Anti-amœbic treatment gave only temporary relief and the abdomen was again opened in May, 1930; the tumour mass was removed. The patient died a few days later from peritonitis and gangrene of the bowel.

In the excised mass the lumen of the bowel was found to be just large enough to admit the little finger. An ulcer was found on the inner wall and sections showed numerous amœbæ at the base of the ulcer and a few deeper in the wall.

The second patient, who was not under the care of the authors, was a male, aged 37, who had been born in the Azores and had spent some time in South America. He gave a history of bowel trouble, with the passage of blood, when he was about 12 years old. There had been pain in the right side for years and the appendix was removed in 1929. The pain continued with occasional vomiting in the morning, looseness of the bowels and loss of weight. Carcinoma was diagnosed.

In May, 1930, at operation a tumour was found in the cæcum which was excised. The patient died some time later after a secondary operation to close a temporary ileostomy.

The lumen of the bowel in the tumour was found to be much contracted; the mass was hard and showed necrotic areas.

In sections the tumour was seen to consist chiefly of fibrous tissue with lymphocytes, eosinophiles and plasma cells. The inner wall of the bowel was ulcerated and in sections many amœbæ were seen at the base of the ulcer.

The third patient, aged 41, suffered from diarrhœa while on service in France, the only foreign country he had ever been in. Since that time there had been occasional recurrences of diarrhœa which had become more severe since 1928. In 1929, examination showed no sign of a tumour and relief was obtained with bismuth treatment. In May, 1930, a recurrence of severe diarrhœa led to an examination when a hard, movable mass was found in the right side of the abdomen, extending from the groin to the

costal margin. This was diagnosed as being a carcinoma. An operation was performed and a tumour involving the cæcum was removed, the mass being the size of two fists. The patient made an uneventful recovery.

The tumour was reported as being "chronic non-specific inflammation of the large bowel." The authors then obtained the specimen and in sections found amœbæ at the base of an ulcer in the cæcum with no evidence of carcinoma.

JACK, J. **Use of Bamboo in Subsoil Drainage.** *Journal of the Royal Sanitary Institute.* 1931, lii, 14.

This is an interesting article on the use of bamboo in subsoil drainage in a flat and swampy district, bordering on the Demerara river, British Guiana, where the soil is impermeable and of a clayey nature. Nothing new or original is claimed by the author in his adaptation of the bamboo pipes for the purpose of drainage in a country where the use of metal or earthenware pipes for sullage water and bath waste in temporary or semi-permanent mining camps is prohibitive owing to the price of these articles. In British Guiana bamboo grows abundantly and to a size of six inches in diameter.

In the preparation of the bamboo pipes green stems of from four to six inches in diameter are selected, trimmed and cut into lengths of about fifteen feet. It is stated that bamboo rapidly cracks and decays when cut and exposed to the sun and rain, but the author has found that it will last for years if cut green and buried in the soil.

The woody septum which divides the hollow stem into sections having been exposed by means of a series of deep notches, penetrating to one-half the thickness of the bamboo, is partly removed; the rest is broken down with a chisel. The "growing eye" is also removed. The pipe then appears as a thick, straight reed, provided at regular intervals with orifices.

The bamboo pipes are placed end to end, with the notched sides downwards in previously prepared shallow herring-bone drains. The pipes should be prevented from lying on the bottom of the drains by means of pieces of hard, round wood, $1\frac{1}{2}$ inches in diameter, placed tranversely to the main axis of the drains at regular intervals and between the notches; this allows water to have full access to the notches. The junctions between lengths of bamboo should be covered with short pieces of bamboo split in half, to prevent earth being washed into the pipes. A similar cover should be placed at the junction of herring-bone pipes with the main, the ends of the former being placed opposite notches in the latter. Cinders, broken bricks, broken bottles and rubble are then filled into the drain, which is finally covered with from two to four inches of soil.

The author advocates a similar arrangement in the case of boggy meadows and small seepage swamps.

The method was adopted in the disposal of sullage water and storm water in native villages and camps. In large main sullage drains, five or six bamboo lines may be laid. The pipes are kept from lying on the

30

bottom of the drain by means of cross pieces of hard wood ; they are then covered with bundles of sticks, and cut grass or palm leaves, to form a rough filter. The trench is then nearly filled with earth and graded to form a wide shallow surface drain for storm water only.

A description of the method of disposal of sullage water from individual houses into soak-pits is given.

The photographs accompanying the article make the author's description very clear.

SCHEUNERT, A. Gemuese als Vitaminquelle. [Vegetables as a Source of Vitamins.] *Deut. Med. Woch.* 1931, v, 57, 835-9.

The author emphasizes that the use of vegetables as an adequate source of vitamins must depend upon the state and preparation of the vegetables, since in such methods of treatment as cooking, sterilizing and preserving, the vitamin content is changed. He has tested various vegetables for their vitamin content, giving them to animals in graded amounts. Vitamin A was tested by giving the vegetable under investigation to young rats on a vitamin A-free diet fourteen days after growth had stopped. The following list shows the richness in, or lack of, vitamin A judged by the effect of the added vegetable in causing the animal to resume growth. Very good and good: green cabbage, mangold, spinach, Brussels sprouts, carrots, tomatoes, mushrooms of a certain type (Pfifferlinge); small amount: red cabbage, cauliflower, green beans, green peas, cucumber, rutabaga; none or only a trace: white turnips, sauerkraut, celery, potatoes, rhubarb, mushrooms (other types than Pfifferlinge), curly cabbage, wax beans. The green leafy vegetables are the best sources of vitamin A, and next to them the red pigmented roots. The amount of vitamin A in any one vegetable is not constant but varies with the season. The ordinary household method of cooking vegetables was found not to destroy vitamin A. Of all the vegetables tested, only mushrooms were found to contain significant amounts of vitamin D.

Using growth as a criterion, vitamin B (complex) was found to be present in practically all vegetables. It is not appreciably destroyed by ordinary cooking or sterilizing, but as it is soluble in the cooking water, a considerable part may be lost unless the water also is used. Green cabbage is the richest source of vitamin B. It is also present in small amounts in sauerkraut, spinach, salad, red cabbage, Brussels sprouts, cauliflower, beans, peas, rutabaga, carrots and potatoes. It is present in very small amounts in cucumber, asparagus and rhubarb.

Tests on guinea-pigs showed that practically all vegetables, especially the green leafy vegetables, contain vitamin C. In the raw state, the following are excellent sources of vitamin C: green cabbage, mangolds, cauliflower, spinach, red cabbage, Brussels sprouts, green peas, turnips, potatoes, tomatoes and asparagus. It is also present in slightly

smaller quantities in sauerkraut, green beans, cucumber, carrots, celery, old potatoes and rhubarb. Vitamin C is lost not only in the water in cooking, but also by destructive oxidation. After cooking in an open or covered vessel, only from $\frac{1}{10}$th to $\frac{1}{20}$th of the original quantity of vitamin C is left. The destruction process is so rapid that the use of a pressure cooker has no advantages over ordinary cooking. In preserving vegetables, the vitamin C content can be retained if the heating takes place in the absence of oxygen. Under such conditions, vitamin C is not destroyed to any great extent by fairly high temperatures. Canning under relatively anaerobic conditions is therefore strongly to be recommended.

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 6, No. 9.

Reviews.

THE DIAGNOSIS AND TREATMENT OF VENEREAL DISEASES IN GENERAL PRACTICE. Fourth Edition. By Brevet Colonel L. W. Harrison, D.S.O., R.A.M.C. (Ret.). London: Humphrey Milford, Oxford University Press. 1931. Pp. xv + 567. Price 25s. net.

The first edition of this book was published in 1918, and it was followed a year later by the second edition; the third edition, published in 1921, was revised and reprinted in 1926; it will thus be seen that this is a popular work.

In the preface to the fourth edition the author states that in order to find room for necessary new material he has eliminated matter which is found in standard books on medicine and surgery.

Colonel Harrison still adheres to the regional system of describing the diseases dealt with, and it is a useful system for the general practitioner, for whom the book is primarily intended.

Descriptions of climatic bubo and granuloma venereum are new matter, and more detail is given on the treatment of soft chancre and of gonorrhœa in the female than in previous editions.

The first half of the book deals with descriptions of the venereal diseases and conditions from which they have to be differentiated; as the space available for this is only about two hundred pages, many of the descriptions have had to be compressed, but they are clear and to the point.

Two chapters are devoted to cerebral and spinal syphilis, and a similar amount of space to special consideration of venereal diseases in women and children.

There are three excellent chapters on the taking of specimens, on laboratory examinations and on laboratory reports, which will be found of great value by practitioners in submitting specimens for laboratory examination and in making use of the information supplied in reports.

There has been little change in the treatment of gonorrhœa since the last edition, but the author considers that the results he has seen in cases treated with vaccine made from gonococci containing Babes bodies are promising. This type of vaccine was first made and used by Major Lyn Dimond when he was working at the Royal Herbert Hospital, Woolwich.

A considerable number of methods of treating gonorrhœa in women are described, and the author states that as one of the preliminary measures he takes a specimen of the patient's blood for complement-fixation test for syphilis and for gonorrhœa, and makes microscopical and cultural examinations for gonococci.

He describes fully the routine treatment which has been used for the last ten years in the women's department of the Venereal Diseases Clinic at St. Thomas's Hospital. He considers that none of the means of treatment at present available is fully satisfactory, and that a specific in the future is more likely to be found in some form of vaccine than in chemotherapy.

Treatment of syphilis is dealt with in one hundred pages, and in these Colonel Harrison gives a most thorough exposition of the use and mode of action of many remedies employed. Finality has not yet been reached in the ideal course of treatment, and the amount of arsenical drugs and of bismuth now recommended in early cases of syphilis is greater than that suggested by the author in the *Practitioner* of February, 1931.

There is a useful chapter on the medico-legal aspects of venereal disease by Dr. F. G. Crookshank, which will be found of value by medical men of all branches of the profession.

In the first of the three appendices there is a list of instruments and appliances used in the diagnosis and treatment of venereal disease.

In the second appendix some common staining methods are given; Leishman's staining method for ordinary films is described, but the author might have stated that if the diluted stain be allowed to act for thirty minutes, *Spirochæta pallida* shows up beautifully in films made from spirochæte-containing lesions.

The third appendix contains short descriptions of complement-fixation tests, including the Wassermann reaction, and of various flocculation tests used in the diagnosis of syphilis; in this latter group there is, on p. 529, a slight misprint in Meinicke's Klärungsreaktion.

The illustrations have been well selected, although one considers that it would be somewhat difficult to recognize *S. pallida* from the two illustrations on Plate XVII, taken from the Medical Research Committee's Special Report Series, No. 19.

This book can be strongly recommended for the diagnosis and treatment of venereal disease, not only in general practice but in the practice of the specialist. The author is to be congratulated on the large amount of valuable information he has been able to present in a volume of modest size.

AN ABC OF MEDICAL HYPNOSIS. By Edwin Hopewell-Ash, M.D., B.S., M.R.C.S., L.R.C.P. Published privately at BM/ELHA, London, W.C.1. Pp. 56. Price 2s.

While comparatively few in the medical profession know anything about hypnosis, there are many who would like to learn something of the subject but are deterred from its study by the vagueness and complexity of most books written about it. To these we can cordially recommend this little work. It is highly practical and written in language refreshingly free from the jargon of the psycho-analytical writer, and imparts as much practical knowledge of the elements of medical hypnosis as may be useful to the man in general practice.

ABDOMINAL PAIN. By John Morley, Ch.M., F.R.C.S., Hon. Assistant Surgeon, Manchester Royal Infirmary, etc. Edinburgh: E. and S. Livingstone. 1931. Pp. xv + 191. 10s. 6d. net.

The question of the origin of abdominal pain has been the subject of much investigation during the past half century, and there are nearly as many theories regarding it as there have been investigators; many of the theories have been evolved as the result of work in the laboratory, unsatisfactory very often when put to practical application. Mr. Morley has approached the subject primarily from the clinical aspect, correlating the facts found on examining the patient with those discovered at operation and those got from experiments made during operations under local anæsthesia. As a result of his investigations he has satisfied himself that abdominal pain, apart from the dull and badly-localized visceral and splanchnic pain, is due to direct irritation of the somatic nerves of the parietal peritoneum by either an inflamed organ or by some foreign matter; this, too, is the cause of deep tenderness and of muscular rigidity. His arguments are so well put and so strongly supported by the records of his experiments and findings, that his theory is very convincing. That it will be the cause of controversy he fully realizes.

The book is well worth reading. Apart from the elaboration of the novel theory, the author has so well described the pain in the various abdominal diseases that present themselves to the surgeon, as to render the volume a valuable help in the diagnosis of these conditions.

PHYSICAL SIGNS IN CLINICAL SURGERY. By Hamilton Bailey, F.R.C.S.Eng. Bristol: John Wright and Sons, Ltd. 1931. Pp. xx + 277. 318 illustrations, some in colour. Price 21s. net.

That this volume has reached a third edition since 1927 speaks for itself. The letterpress has been revised and a chapter on gangrene added. The illustrations which are a distinctive feature (numbering 318 in 277 pages) are excellent.

This is a book of real value to those commencing the study of surgery, and to those recently qualified. Throughout a surgical career it will be useful as a book of reference.

J. M. W.

THE SEXUAL LIFE OF MAN. By Dr. Placzek. London: John Bale, Sons and Danielsson, Ltd. 1931. Pp. xx + 314. Price 12s. 6d. net.

The author has produced a very lucid and concise treatise on a difficult but very important subject. The chapters on "Genital Gland Deficiency" and on "Aberrations of the Sexual Impulse" contain much that is of practical value from psychiatric and forensic standpoints.

The book is recommended to all those who are interested in the scientific study of sex problems.

Notice.

"HYPOLOID" "EPINALIN" (ADRENALIN AND EPHEDRINE SOLUTION).

"HYPOLOID" "EPINALIN" contains adrenalin and ephedrine in sterilized solution ready for immediate hypodermic injection. Each cubic centimetre contains adrenalin 0·0001 gramme (= 1 in 10,000) and ephedrine sulphate 0·02 gramme (= 1 in 50).

It is now acknowledged that adrenalin and ephedrine have similar pharmacological actions. The effects of ephedrine, although much less powerful and prompt than those of adrenalin, are more prolonged. In "Epinalin," Burroughs Wellcome and Co. offer a medicament in which the powerful but relatively transient action of the adrenalin is followed by the continued action of the ephedrine.

"Hypoloid" "Epinalin" can be injected hypodermically when a specially speedy reaction is considered desirable.

INDEX TO VOLUME LVII.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette*."

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—

G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C. 2.

No. 6. December, 1931. Vol. LVII.

Journal

OF THE

Royal Army Medical Corps

ISSUED MONTHLY

EDITOR.

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTANT EDITOR.

LIEUTENANT-COLONEL A. DAWSON, R.A.M.C.

MANAGER.

MAJOR S. W. KYLE, R.A.M.C.

CONTENTS.

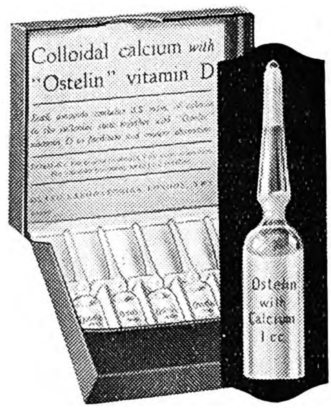
JOHN BALE, SONS & DANIELSSON, LTD.
83-91, GREAT TITCHFIELD STREET, LONDON, W.1

Price Two Shillings net

Right hand page to face matter

Colloidal Calcium

with Ostelin vitamin D

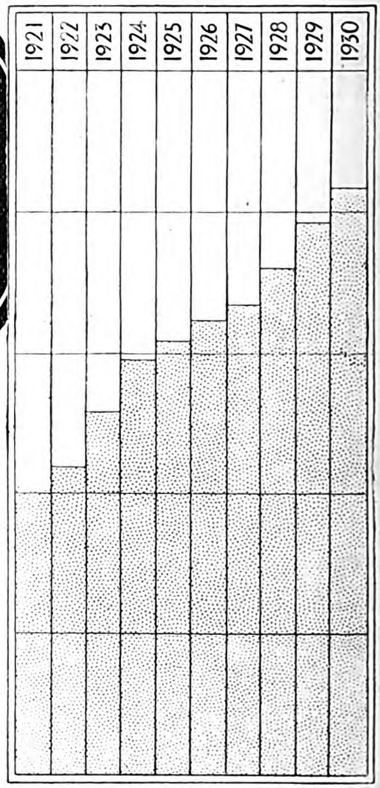


A new preparation for use where a very rapid increase in the calcium content of the blood is desired. These ampoules have been used with notable success in treatment of

Skin diseases—as psoriasis, eczema and furunculosis.
Disturbance of the capillary vasomotor system.
Nutritional failure as in tuberculosis.
Nervous debility including migraine.
Hæmorrhage and menorrhagia.
Delayed union of fractures.

For further information please apply to: GLAXO LABORATORIES, 56, Osnaburgh St., London, N.W.1

Facts WHICH SPEAK for THEMSELVES!



COW & GATE Sales Growth.

COW & GATE Milk Food is now supplied to almost every Hospital and Welfare Centre in this country, and it's certainly not chosen for the sake of cheapness.

We illustrate here a graph showing the COW & GATE sales growth during the last ten years.

THERE MUST BE A REASON FOR THIS EXTRAORDINARY GROWTH!

It is because the Medical Profession has over a long period proved the value of COW & GATE, and insist on having the best!!

Support Home Agriculture. COW & GATE LIMITED is an all English Firm, using only home produced milk.

Write for particulars of our special Milk Foods for difficult Infant Cases.

"The best milk for babies, when natural feeding fails"

INSIST ON COW & GATE FEEDERS · 8 oz. & 4 oz.

COW & GATE LTD GUILDFORD SURREY ©26